The Financial Value of Champagne Houses in a Cobweb Economy

Francis Declerck[1] and L. Martin Cloutier[2]

[1]ESSEC Business School Paris-Singapore, B.P. 50105 - 95021 Cergy-Pontoise Cedex - France
declerck@essec.fr
[2]University of Quebec at Montreal, P.O. Box 6192, Downtown Station
Montreal, QC H3C 4R2 Canada,
cloutier.martin@uqam.ca

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[1]ESSEC Business School Paris-Singapore, B.P. 50105 - 95021 Cergy-Pontoise Cedex - France
E-mail: declerck@essec.fr

[2]University of Quebec at Montreal, P.O. Box 6192, Downtown Station
Montreal, QC H3C 4R2 Canada, E-mail: cloutier.martin@uqam.ca

Abstract

The objective of the paper is to simulate the corporate value of Champagne makers by taking into account the Champagne market evolution. These measurements are conducted by linking financial debt, performance and valuation to a vertical coordination model of production-consumption within a cobweb economy. The overall model uses the dynamic structure that underlies the strategic interactions amongst grape producers and wine makers. These segments coordinate grape production and trade by forming expectations about final consumption, price and stock risks. The paper examines the dynamics of the financial cash flows and net worth of Champagne houses for the 1977 – 2003 period using system dynamics (SD) modeling principles. The results presented in this paper report on key financial indicators for that period for financial debt, performance and valuation of Champagne makers. It provides a sound basis to pursue this work, because the model can further enhanced to anticipate the possible value Champagne makers for the coming crucial years since the Champagne appellation has reached its geographical limit determined by the protected designation of origin (PDO), while worldwide demand continues to grow.

Keywords: *financial valuation, vertical coordination, cobweb economy, system dynamics, price expectations, Champagne, wine*

1.Introduction: Context of the Champagne Makers

The Champagne business amounted to 4.1 billion euros in 2006. It involves more than 15,000 vine growers in the area of Champagne appellation and more than 100 Champagne makers, called houses of Champagne. Several houses of Champagne were sold in the last ten years as highlighted in table 1. The paper models corporate values overtime, in connection with a production-consumption cobweb phenomenon modeled by Declerck and Cloutier (2006).

It takes approximately three years to produce Champagne from raw grapes. Champagne makers face price risks and uncertainty when purchasing grapes, the most important input in the production process. Furthermore, wine, used as input into the process, must be produced within the protected designation of origin (PDO) / protected geographical indication (PGI) area according to specific EU rules. Mistaken expectations when decisions are made about crops planted may lead to fluctuations in market prices. The cycle adjustment of supply and demand leads to jumps and drops in retail prices during economic booms and busts, respectively.

Demand has increased 3% annually over the last 25 years. The area in production has increased similarly. But in 2002, the area planted amounts to about 31 000 ha, which is nearing to the legal PDO size limit. Soon, the constraint will be very binding in the coming years. This resource constraint will bring additional pressure on vineyard values with the set of expected consequences into the functioning of the industry.

Table 1. Major acquisitions of Champagne Houses, 1997-2007

Date	Acquirer	Target	Amount of the deal (in million euros)	Seller
1997	Groupe Vranken	Heidsieck Monopole, with 22 ha of vineyard	about 33.5	Seagram
1997	Boizel Chanoine Champagne	Philipponnat et Abel Lepître		Marie Brizard
1998	Groupe Thiénot	Joseph Perrier, with 21 ha of vineyard		Laurent-Perrier owned 50.5%
1998	Groupe LVMH	De Venoge, with 17 ha of vineyard		Rémy-Cointreau
1998	Boizel Chanoine Champagne	De Venoge, without vineyard	about 30.5	Groupe LVMH
1998	Boizel Chanoine Champagne	Alexandre Bonnet, with 41 ha of vineyard		Family company
1998	Champagne Delbeck (Financière Martin)	Champagne Bricout		Kupferberg
1999	Groupe LVMH	Krug, with 19 ha of vineyard	152	Rémy-Cointreau
1999	Groupe Vranken	Henri Germain		Frey
1999	Hicks, Muse Tate & Furst	Mumm et Perrier –Jouët, with 275 ha of vineyard	297	Seagram (Canadian Co.)
2000	Allied Domecq	Mumm et Perrier –Jouët, with 275 ha of vineyard	575	Hicks, Muse Tate & Furst (US funds) and Frey (French fund)
2002	Groupe Vranken Monopole	Pommery	About 150	Groupe LVMH
2003	Groupes LVMH et Vranken	Bricout-Delbeck		Financière Martin
2003	Groupe Thiénot	Canard-Duchêne	About 180	Groupe LVMH
2003	De Cazanove	Medot		
2004	Laurent-Perrier	Château Malakoff, with 60 ha of vineyard		Family company
2004	Caisse d'Epargne	Groupe Marne et Champagne	44% of the house	MORA family
2004	Groupe Boizel Chanoine Champagne (BCC)	Champagne René Jardin with 21 ha of vineyard s	About 23	
2004	Compagnie financière Frey	Champagne Billecart-Salmon with 9 ha of vineyard	45% of the house	BEH (from Luxembourg)
2005	Holding Société Jacques Bollinger (Champagne Bollinger)	Champagne Ayala, without vineyard		Compagnie financière Frey
2005	Pernod-Ricard	Allied-Domecq, including Champagne Mumm and Champagne Perrier-Jouët, with275 ha of vineyard	10,700 (the whole group)	Allied-Domecq (British Co.)
2005	Starwood	Groupe Taittinger, including Champagne Taittinger with 287 ha of vineyard and hotels	About 1,166	Groupe Taittinger
2006	Groupe Boizel Chanoine Champagne (BCC) Offre amicale le 20/01/06	Groupe Lanson International		56% MORA family 44% Caisse d'épargne
2006	Crédit Agricole du Nord-Est and the Taittinger family	Champagne Taittinger with 287 ha of vineyard 287 ha de vignes Carneros (Californian domain in the USA) Bouvet-Ladubay (Saumur wine in France)	660,000	Starwood (US hotel Co.)

Wine makers negotiate the volume of grapes they purchase in forming expectations about the demand for bottles three years later. But, weather conditions (hail particularly as was the case in 2003) may lead to grape yields that are significantly lower than expected: 8 255 kg/ha, rather than the typical mean of 13,000 kg/ha in 2003.

Cobweb phenomenon at the production-consumption interface disturbs consumers and seriously affects the strategic position of wine makers, which have typically responded by introducing, or amending, vertical coordination rules. The production-consumption has been modeled by Declerck and Cloutier (2006). Within the scope of this paper, it is expanded with the financial structure and performance of Champagne makers, and additional production and financial feedback loops. The objective of the paper is to project the financial debt level and performance of Champagne makers over time. Both parameters can help anticipate the financial value of Champagne makers during the 1977 - 2003 period and to position work for future enhancements of the model.

The remainder of the paper is organized as follows. The second section presents a literature overview of the financial concepts associated to corporate valuation and the ones pertaining to vertical coordination and the cobweb economy. The third section provides an overview of strategic issues associated with the Champagne industry. The fourth section focuses on research methods: the details of the hypotheses to be tested, model design, data sources and model calibration, are presented. The fifth section exhibits simulation results to illustrate the functioning of the model. Finally, conclusions are drawn and discussed.

2. Literature Review

This section presents a brief literature overview of the financial concepts related to corporate valuation and the concepts associated with vertical coordination and the cobweb economy.

2.1 Corporate finance: Corporate value maximization

Corporations act in their owners' interest, thus, they must to maximize shareholders' share value. This is executed through a series of business and financial decisions. Business decisions are presented first and then financial decisions are described. Business decisions involve investment decisions. Investments are conducted to increase profits and then firm value. According to the Modigliani-Miller separation theorem (Modigliani and Miller, 1958), investment decisions are independent from financing decisions.

The most important financial decision is to choose the level of financial leverage. Financial leverage affects firm value in two ways: (1) Interest expenses are income tax deductible, and (2) Financial leverage increases bankruptcy costs because risks of default of interest payments or/ and debt capital repayment. Corporations will increase their financial debt as long as bankruptcy costs remain low (Modigliani and Miller, 1958). Hence, corporations will maximize their value.

2.2. Mechanisms of vertical organization (transactions costs, theory of contracts)

The literature on transaction costs mentions that the strategy of vertical integration is implemented for efficiency purposes (Williamson, 1991). Based on a microeconomics and agency costs theories, Lajili et al. (2007) suggest that vertical coordination is the most likely governance choice in case of: (1) high asset specificity and high uncertainty, (2) higher uncertainty about

volume demanded, (3) small number of potential trading partners, (4) difficulty in ascertaining quality of products by inspection so that the monitoring of inputs is crucial, (5) more effective monitoring of inputs, (6) high frequency of transactions, (7) low uncertainty about the timing of the obsolescence of specific assets, (8) the non-separability of inputs monitoring, and (9) increased complexity.

To generate a sustainable competitive advantage, decision-makers achieve economic cost minimization of production and transaction costs via organizational design selection (Klein et al., 1978; Mahoney, 2004; Teece, 1984; Williamson 1975, 1985, 1991b; Milgrom and Roberts, 1992). In a study on the food manufacturing industry, Peterson et al. (2001) have suggested that the vertical coordination strategy continuum can take five major forms: spot markets, specification contracts, relationship-based alliances, equity-based alliances, and vertical integration.

Time uncertainty leads to fragmented vertically coordinated markets and favors short-term tactics rather than-long term strategies (Cloutier, 1999). Managers forecast consumer demand and anticipate the reaction of other suppliers to market circumstances to adjust their own supply. Economic business fluctuations and imbalance due to external shocks are amplified by endogenous mechanisms of production and marketing, because of uncertain information and time delays in adjusting supply to demand (Ruth et al., 1998). A long term strategy is in the economic interest of agents in a given sector, from producers to consumers. A long-term strategy fosters: (a) better performance of operations, (b) stable quality standards, (c) sound financial situations and (d) risk-sharing among the different operators along the value chain (Sterman, 2000).

2.3. Economic expectations and the 'cobweb' phenomena

The expectations held by economic agents perform a key role in shaping dynamic behavior in economics and finance. They affect outcomes and further influence expectations through assimilated learning and feedback. The role of expectations is crucial in speculative markets such as the one of the Champagne grape. Due to grape annual production and the time required for wine maturing, markets operate from year to year. But long-term investments in productive assets create a lagged supply adjustment to demand. Ezekiel (1938) describes the 'cobweb' phenomena, with the introduction of a theorem to explain how supply reacts to the lagged price, and the demand adjusts to the current price. Nerlove (1958) observes adaptive expectations within the confines of the cobweb phenomena. Cobweb strategy experiments have been used by researchers interested in the formation of expectations and of their impacts. Subjects in experiments formulate a complete strategy with price forecasts for all possible states of the world. From period-to-period, experiment subjects may learn the market supply and demand from past period experience and begin to form expectations (Sterman, 1988, 1989).

Further, Colucci and Valori (2006) examine feedback in agents' expectations by introducing alternative learning rules to understand actual human behavior in experiments on expectation formation in a cobweb economy. The conclusion is that decision-makers may have a strong ability to understand the impact of their expectation feedbacks. Agents form expectations repeatedly, perhaps even over many production cycles, and have ample opportunity to learn and change their expectation, strategy and behavior. Historical experience is an important component of that process, but history never exactly repeats itself in periodicity and amplitude. Expectations may turn out to be incorrect and lead to cyclical variations in prices. Mistaken expectations when wine making decisions are made about the grape purchase may lead to fluctuations in market prices.

Wine makers negotiate the volume of grapes they purchase in forming expectations about the demand for bottles three years later. But, weather conditions may lead to yields of grapes that are at lot lower than expected: 8,255 kg/ha instead of 13,000 kg/ha in 2003.
Variations in the price of Champagne are brought only by mistaken expectations and by variable weather conditions. They show that when particular expectations are held in common by competing producers, actions taken by them may lead to a disappointment about these expectations.

2.4. Vertical coordination between grape producers and Champagne makers

Lajili et al. (2007) submit that several factors can explain why the making of Champagne is easier through vertical coordination between vine growers and wine makers:

1) This factor is high asset specificity and high uncertainty: The Champagne industry must comply with the legal restrictions concerning both quantity and quality on materials, method and location. These rules induce major barriers to entry and exit in the Champagne market. Specific barriers to entry are related to PDO rules: Champagne grapes must be harvested and processed into wine within the geographic area of appellation with specific technological and agronomic requirements, including the variety of vines grown, manual-only harvest, maximum authorized yield, and the storage of ageing wine during three years (leading to more than one billion bottles aging in cellars), a process that requires financing.
But weather fluctuation is a risk factor affecting the production of grapes at certain critical stages.
2) This factor relates to high uncertainty about the demand volume. Because it takes about three years from the grape harvest until ready-to-drink Champagne bottles can be sold, Champagne makers face market risk and uncertainty at the time they buy grapes. When wine makers buy grapes, they form expectations about the price of bottles three years later.
3) This factor relates to the small numbers of potential trading partners. Within the industry, Champagne makers only own 10% of the vineyards but their market share reaches 66% of the total wine sold. Champagne makers must purchase grapes in the PDO area. The grape market consisted of a large number of vine growers (about 18 000) facing a small number of buyers (200 brokers and Champagne makers) in 1 200 locations.
4) This factor is associated with the difficulty in ascertaining final product quality by inspection so the monitoring of inputs is crucial.
5) This factor relates to the more effective monitoring of inputs. The monitoring of grapes quality is not easy in a bottle of Champagne by inspection so that the monitoring of inputs is required. Four-year contracts are signed by both parties (vine growers and wine markers). Every transaction is recorded officially by a committee (CIVC) financed by both parties in order to inform publicly about prices to ease relationships.
6) This factor concerns the increased complexity of PDO regulations and contracting rules over time. From 1959 to 1990, a contract governed all prices for grapes and also the allocation of stocks to wine-makers; that is, vertical coordination linkages between grape producers and Champagne makers were rigid. In recent years, four-fifth of grape purchases has been conducted using individual contracts, and the remaining purchases occur on the spot market at the time of harvest. The market remains loosely oligopolistic since six major wine makers purchase about 60% of grapes.

2.5. Consumption-Production cycle of Champagne: Stylized facts about vertical coordination

Market sales of Champagne amounted to 3.9 billion euros in 2004 (CIVC, 2005). On the demand side, shipments of bottles from wine makers to the retailers vary from year to year because of swings in economic growth in developed countries (CIVC, 1992 - 2004). Often, a drop in Champagne sales occurs three or four years after an economic boom, when the grapes used to make the bottles on sale were purchased at a peak price because wine makers and vine growers anticipated a continuing expansion. Consequently, wine makers' profits may fluctuate a lot from year to year (Declerck, 2005).

On the supply side, decisions taken in the adjustments for the DPO and authorized yields, together with short-term adjustments to demand pressures by principal wine makers, seem to lead to a cobweb phenomenon. As seen on figure 1, over the past three decades, one can observe that patterns of consumption have exhibited three asymmetric production cycles with peaks of sales, and price per bottle in 1979, 1989 and 1999, while sales and prices lows, following these peaks, occur following a three-year time lag (Declerck, 2005).

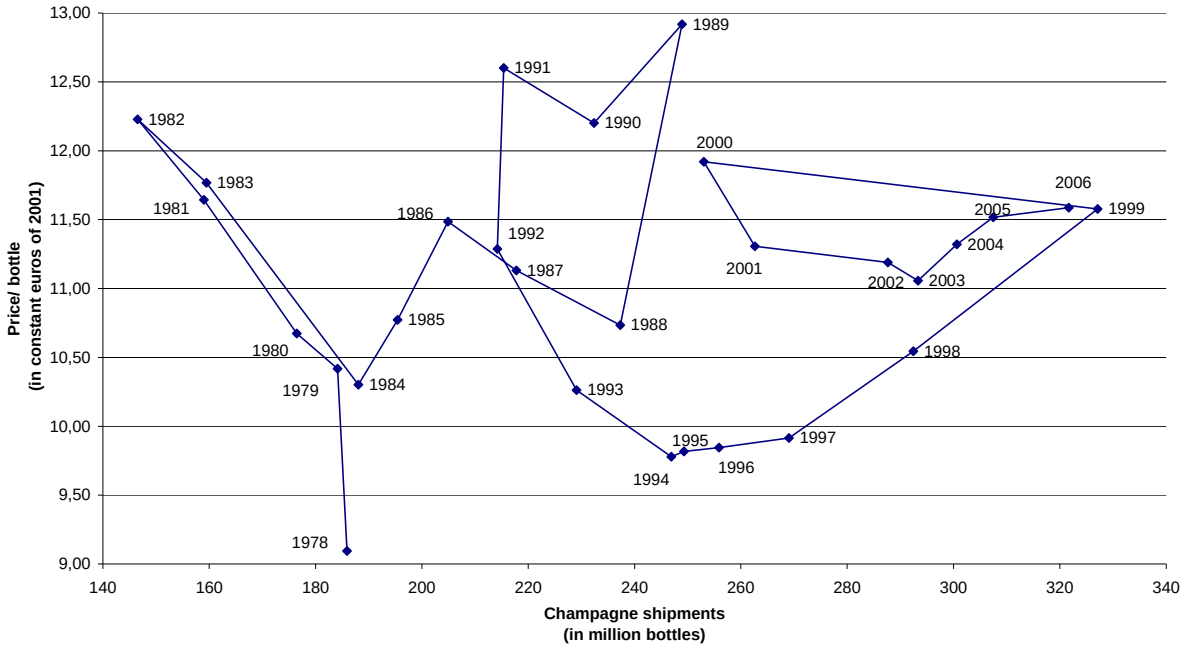

Figure 1. Shipments of Champagne from 1978 to 2006 in function deflated price per bottle expressed in constant terms (base: 2001, €)

Source: Updated from Declerck and Cloutier (2006).

In 1982, 1992 and 2001, the industry faced a lower selling price and high production costs for bottles elaborated with grapes harvested three years earlier, and purchased at a historic high price when the consumer demand for Champagne was high. Following each cycle, the mechanisms of vertical coordination in place to mitigate temporal uncertainty and financial risks, mostly associated with the storage of bottles, were not sufficient to adjust to short-term pressures in demand, and were amended.

3. Research Methods

The modeling approach used in this paper is based on the principles of systems dynamics (SD). System dynamics models are based on the principles of identifying feedback loops and explicitly taking into account the passage of time by introducing time delays in the modeling process (Sterman, 2006). The first step in the modeling process is to identify the problem and its scope. This was accomplished by combining the existing production-consumption model (see Declerck and Cloutier, 2006) with key financial feedback loops that drive the materialization of the valuation process of champagne wine makers. The production-consumption submodel employed in this paper has been outlined in previous publications (Declerck and Cloutier, 2004), and has been calibrated to historical consistency with stylized facts about the industry (historical stocks, price series, production areas and capacity, grape yields, etc., for the 1977 – 2003 period), and it was also used in conducting prospective studies.

To expand the production-consumption model to include the capability for market valuation, a submodel was designed on the same historical period to include the possibility to use the financial theory of the leverage effect, and the Modigliani-Miller corporate value measurement. Then an influence diagram (ID) outlining the major and key relationships of the now production-consumption subsector integrated with a financial subsector were outlined for the financial valuation component. In SD principles, the ID represents the "dynamic hypothesis" of a model, it is a "maintained" hypothesis of the way a model structure is characterizing a given system. One of the most delicate dimensions of the model design is to identify key feedback loops between the production-consumption and financial submodels. The resulting ID is represented in figure 2. The main aspect of the dynamic hypothesis, as it relates to the corporate valuation examined in this paper is to explain how the feedback loops between production variables (according to the phase of the cycle), on the one hand, and financial debt level and performance of Champagne makers, on another hand (Declerck, 2005). This opens a range of possibilities for a newer understanding and demonstration of the impact of the Champagne production–consumption cycle on the financial structure and performance of Champagne makers, and back.

The third step in the SD research process consists in translating the ID into a quantitative level-rate model and in its calibration using historical data. The level-rate model was designed using the software Powersim. The details about the production-consumption subsector of the model are described in Declerck and Cloutier (2006). The production-consumption subsector uses data and estimated fitted curves for production and consumption from the Champagne trade association (CIVC, 1978 - 2003). The financial subsector was calibrated using financial data compiled by Banque de France on the Champagne industry (Banque de France, 1978 – 2003). The links established between the two submodels and the connection between these data sets use a series of assumptions and "checks" into the data can be obtained from the authors.

The fourth step consists in assessing the model for both its internal and external consistencies. It is the case, that within the context of this research, there are data available against which it is possible to check for historical consistency on most level and rate variables of the model. Note that economic and financial theories form underlying principles employed in identifying the feedback for building the model.

Finally, some financial indicators were selected to examine the behavior of the model. These are, the Champagne Houses' estimated financial values using market multiples. According to Declerck (2005), it is assumed that Champagne Houses' corporate value is worth four times its sales, twelve times its EBITDA, fifteen times its EBIT and twenty-two times its net profit.

These financial intermediate variables were estimated according to corporate decisions rules: investment decision, financial debt leverage and time horizon of loans, dividend policy and depreciation rate.

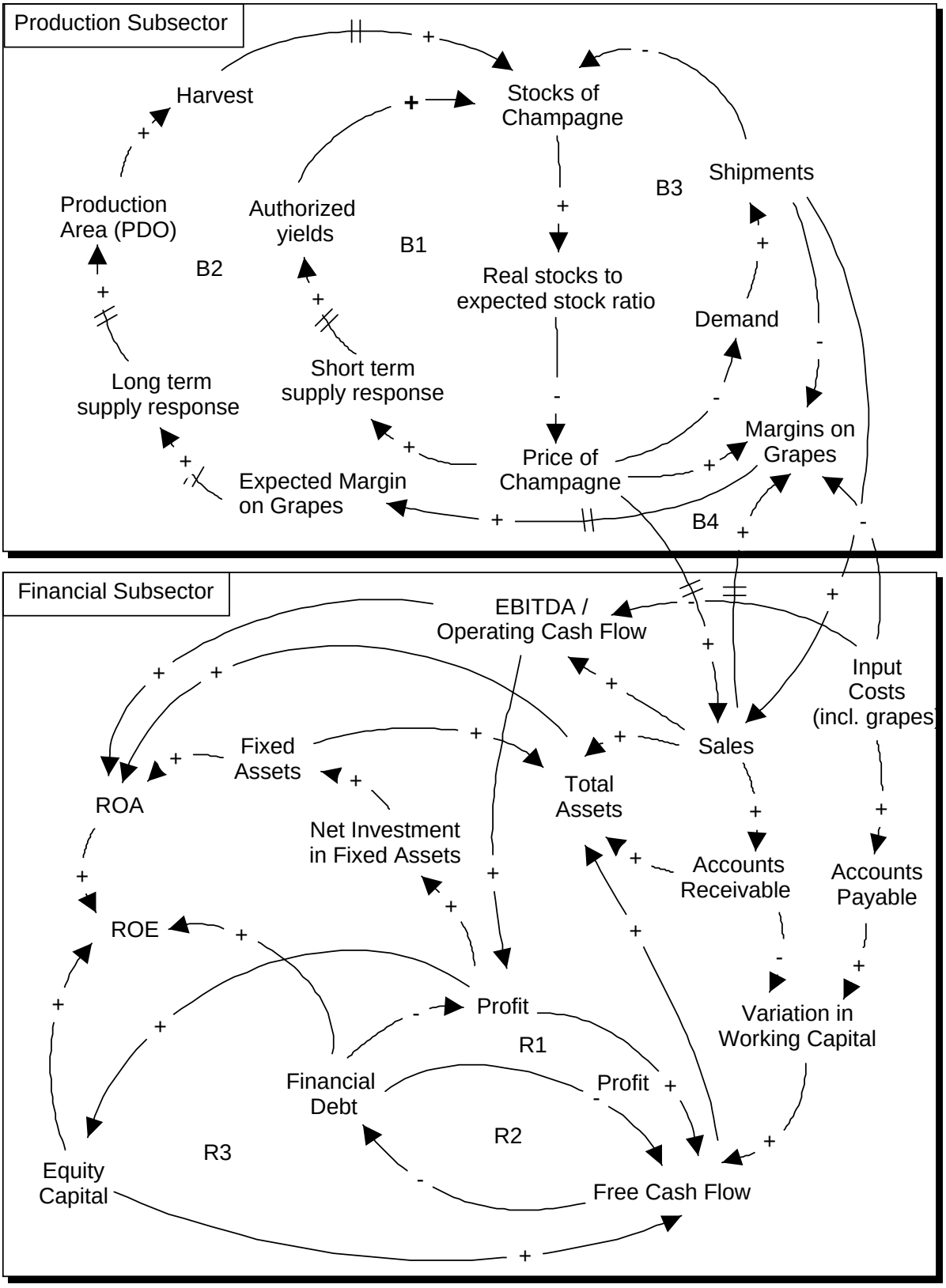

Figure 2. Diagram of influence about Champagne production and value of Champagne houses

4. Influence Diagram: Dynamic Hypothesis

Figure 2 presents the influence diagram (ID) for both the production-consumption and financial subsectors to value the houses of Champagne. The production-consumption subsector includes four balancing feedback loops. The finance subsector includes three reinforcing feeback loops. At the interface between the production-consumption and the finance subsectors there is one balancing loop.
Feedback loop B1 is the short-term supply response of producers. The price of champagne influences the increase in authorized yields, which in turn will increase the stocks produced. Similarly, the balancing feedback loop B2, describes the long-term supply response of producers, this time, the margins on grapes leads to the formation of expectations, and to long term pressures to increase the production area (PDO). Both balancing loops B1 and B2 will produce more wine bottles and structure the supply dynamics. The balancing loop B3, corresponds to consumer demand and shipments. The price of Champagne drives the demand.
The finance subsector includes three level variables in the level-rate version of the model: (1) fixed assets, (2) equity capital, and (3) financial debt. But, in the ID, only three main reinforcing feedback loops are represented. In this model, the feedback loop R2, shows that an increase in free cash flow lowers the financial debt. Conversely, lower financial debt leads to greater free cash flow. In addition, from feedback loop R1, the higher the financial debt, the more profits will be eroded. Profits produce greater cash flow. In the reinforcing loop R3, greater profits, generate equity capital, which in then produce greater cash flow.
The key elements that connect the two subsectors of the model are part of the balancing loop B4. Two main sets of influences were established between the submodels. First, balancing loop B4, endogenizes the sales level (price multiplied by shipments (quantity)), from the production subsector to the finance subsector to determine the total sales in the industry. Second, the finance subsector endogenizes the margins on grapes, calculated from sales and input costs, which influences the long-term supply response in the production-consumption submodel.

5. Results

The results of the model are provided from 1977 to 2003. Simulated stocks of Champagne bottles show similar patterns to historic stocks, as drawn on figure 3. It signals the robustness of the model.
Figure 4 shows that the level of financial debt increases strongly during the last decade. Surprisingly, the financial expenses are more variable as plotted on figure 5.

Figure 6 exhibits four estimations of the valuation of Champagne houses: the value of sales, EBITDA, EBIT and net profit. The value of Champagne sales has strongly increased since 1997. It presents patterns that are very different from those shown by other market multiples, such as EBITDA, EBIT and net income. Corporate valuation using EBITDA, EBIT and net profit are very consistent. EBITDA, EBIT and net profit made by Champagne Houses, that are key elements used for valuation with market multiples. The measures are dependent on the difference between the sales and the input cost of grapes. The financial effect of leverage is positive since net profit has increased from 1999 while financial debts have also grown fast.

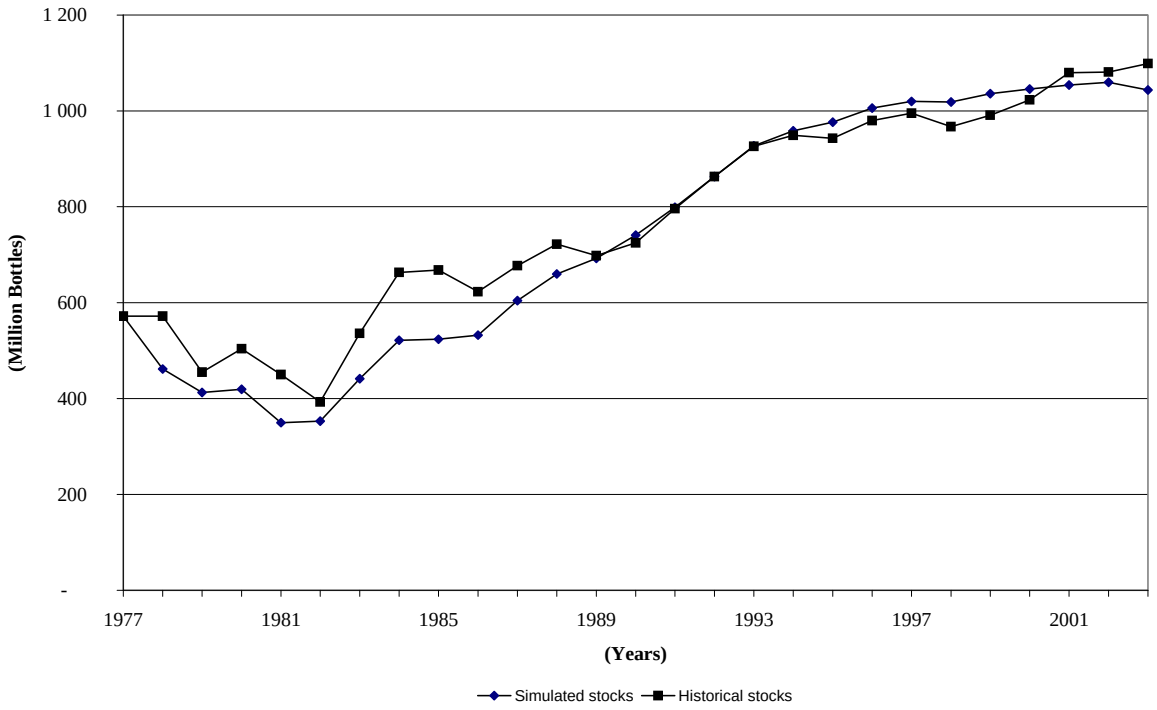

Figure 3. Stocks of Champagne bottles from 1977 to 2003: historic and simulated levels

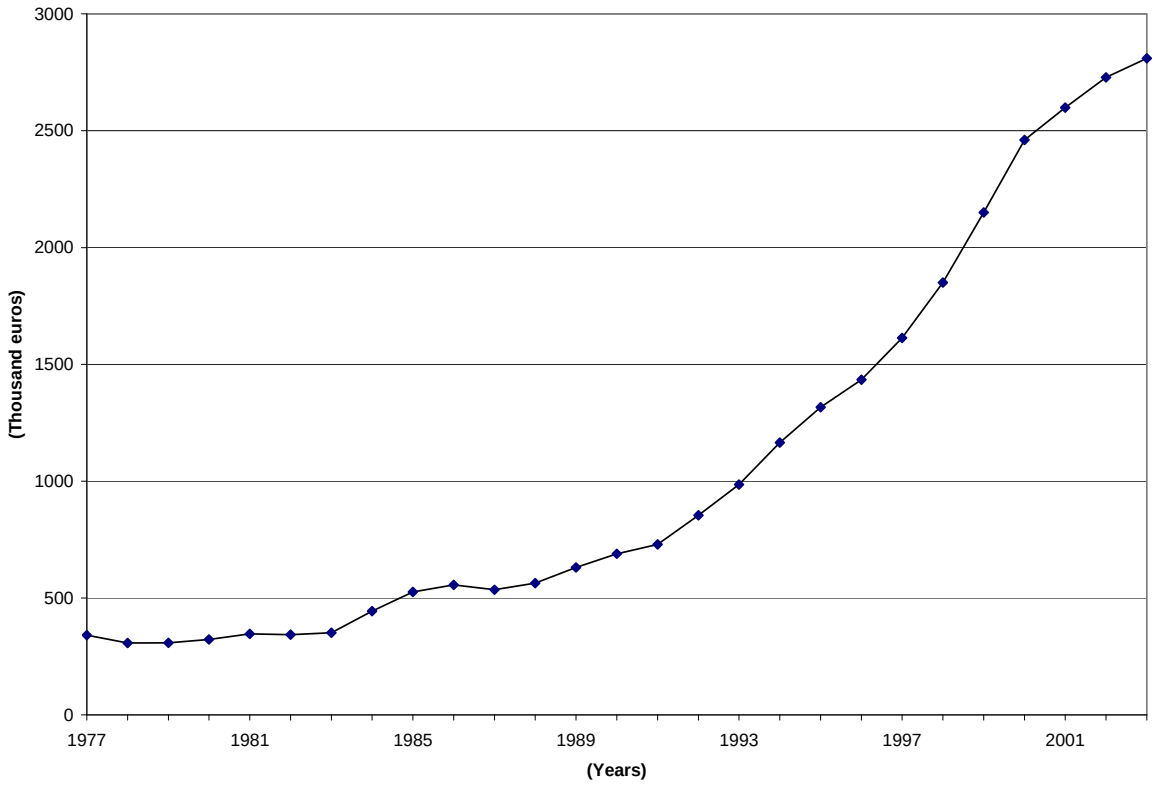

Figure 4. Simulated Financial Debt of Champagne Houses from 1977 to 2003

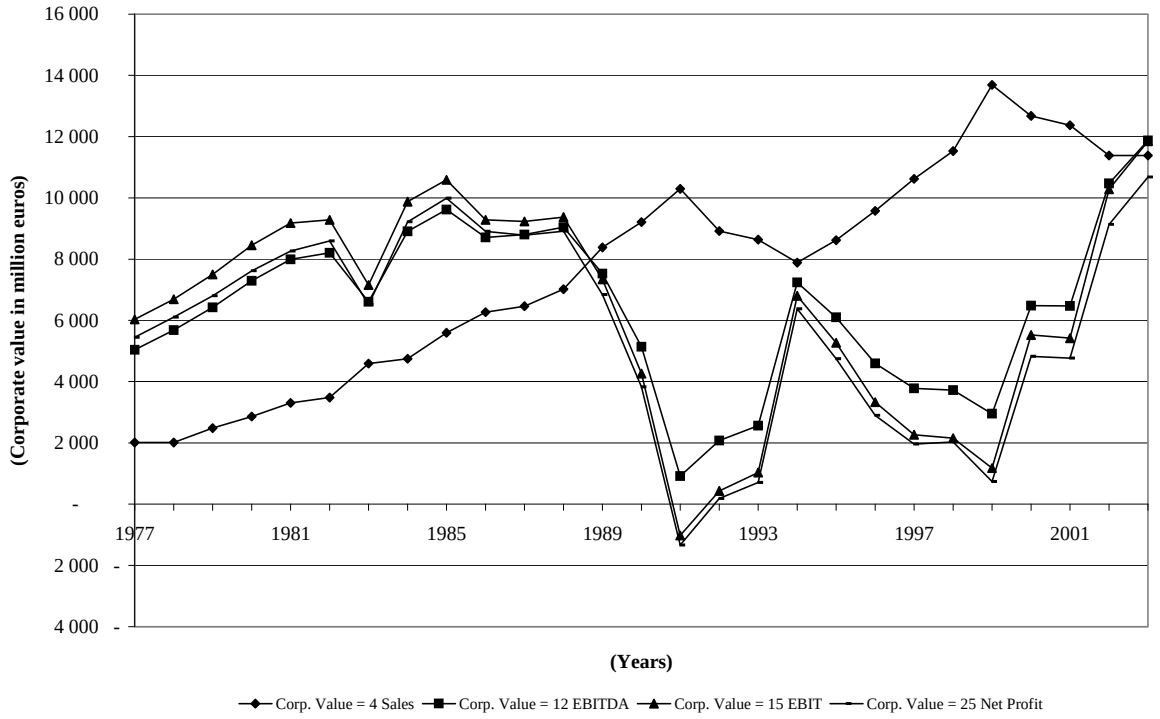

Figure 5. Simulated Financial expenses paid by Champagne Houses from 1977 to 2003

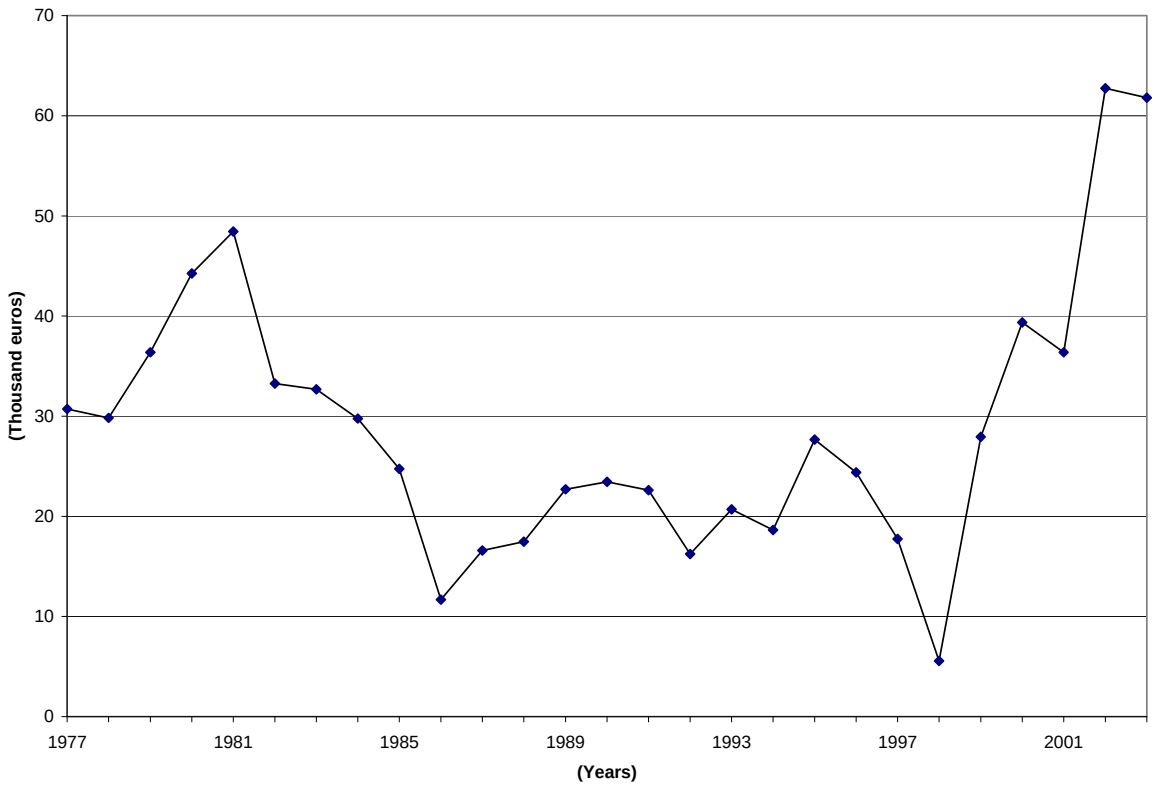

Figure 6. Simulated Corporate Value of Champagne Houses from 1977 to 2003

5. Conclusion and Perspectives

The corporate value of Champagne houses has been modelled by linking a production-consumption phenomenon to financial measures. Corporate values of Champagne houses are estimated as four times their sales, twelve times their EBITDA, fifteen times their EBIT and twenty-two times their net profit.

Next step in further research may be to set up scenarios for the future decade. Scenarios may be conducted in assuming different levels of demand growth while supply is constrained by legal rules (the size limit of the area in appellation has been reached; the yield level is limited but could be modified quite easily). Different assumptions may also be assessed on the supply side. Then, the market price of Champagne may be found and the input cost of grapes may be inferred. On the side of Champagne house, the needs in investment and financial debt can be computed. So expected sales, EBITDA, EBIT and net profit can be estimated. Consequently, the corporate value of Champagne houses can be estimated year after year.

Such a model is a useful guide to decision-maker because it helps anticipate better corporate value and to understand the future of value creation in the context where the features of the DPO are being revised. Such a model is particularly useful for Champagne houses and vine growers who negotiate authorized annual yield and the revision of the area of appellation together and with the State and European authority.

6. References

Banque de France, Financial data from 1978 to 2002.

CIVC (Comité interprofessionnel du vin de Champagne), Economic data from 1978 to 2006.

Cloutier, LM. 1999. *Economic and Strategic Implications of Coordination Mechanisms in Value Chains : A Nonlinear and Dynamic Synthesis*. Ph.D. Dissertation. University of Illinois at Urbana-Champaign.

Cloutier LM, Rowley R. 2003. Simulation, quantitative economics and econometrics: electronic infrastructure and challenges to methodological standards. *European Journal of Economic and Social Systems*, **16**: 11-32.

Colucci D, Valori V. (2006). Ways of learning in a simple economic setting: a comparison. *Chaos, Solitons & Fractals*, **29**: 653-670.

Declerck F. 2005. Managing price cycles in the Champagne industry. *Agribusiness: An International Journal*, **21**: 1 -14.

Declerck F. & M.L. Cloutier, « Vertical Coordination Mechanisms in a Cobweb Economy: A System Dynamics Model of the Champagne Industry", *Proceedings of the 3rd International Wine Business & Marketing Conference*, Institut des Hautes Etudes de la Vigne et du Vin at Montpellier, 6-8 July 2006.

Ezekiel M. 1938. The cobweb theorem. *Quarterly Journal of Economics*, **52**: 255-280.

Forrester JW, Senge PM. 1980. Tests for building confidence in system dynamics models. In *System Dynamics*, Legasto AA Jr., Forrester JW., Lyneis JM. (eds). Elsevier North-Holland: New York: 209-228.

Klein B, Crawford RJ, Alchian AA. 1978. Vertical integration, appropriate rents and the competitive contracting process. *Journal of Law and Economics*, **21**: 297-326.

Lajili K., M. Madunic & J.T. Mahoney. 2007. Testing Organizational Economic Theories of Vertical Integration. *Research Methodology in Strategy and Management*, 4: 343-368.

Mahoney JT. 2004. *Economics of Foundation Theory*. Sage Publications Inc.: Thousand Oaks, CA.

Meadows D. 1970. *Dynamics of Commodity Production Cycles.* Wright-Allen: Cambridge, MA.

Milgrom PR., Roberts J. 1992. *Economics, Organization, and Management*. Englewood Cliffs, NJ: Prentice Hall.

Modigliani F., & M.H. Miller, 1958. The Cost of Capital, Corporation Finance and the Theory of Investment. *American Economic Review,* 48: 3.

Nerlove M. 1958. Adaptative expectations and cobweb phenomena. *Quarterly Journal of Economics,* **72**: 227-240.

Sterman JD. 1988. Deterministic chaos in models of human behaviour: methodological issues and experimental results. *System Dynamic Review,* **4**: 148-178.

Sterman JD. 1989. Misperception of feedback in dynamic decision making. *Organizational Behavior and Human Decision Processes,* **4**: 148-178.

Sterman JD. 2000. *Business Dynamics: Systems Thinking and Modeling for a Complex World*. Irwin/McGraw-Hill: Boston, MA.

Sterman, JD. 2001. System dynamics: Tools to learn in a complex world. *California Management Review,* **43**: 8-23.

Teece DJ. 1984. Economic analysis and strategic management. *California Management Review,* **25**: 87-110.

Williamson OE. 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*. Free Press: New York.

Williamson OE. 1985. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. Free Press: New York.

Williamson OE. 1991. Strategizing, economizing, and economic organization. *Strategic Management Journal,* **12**: 75-94.