

Intangible effort and performance: the case of the French wine industry

Paul Amadiou, CR2M, University of Montpellier
Jean-Laurent Viviani, ERFI, University of Montpellier

paul.amadiou@univ-montp1.fr

jviviani@univ-montp1.fr

Abstract: Because of increase in the competing pressure in the wine industry, French companies wonder about the strategies to adopt to defend their competitive position. The strategic axes considered, development of a market orientation, increase in research development and commercial expenditure, recruitment and training of qualified personnel are characterized by the creation and development of an intangible capital.

The objective of paper is in a first stage to measure the importance of intangible expenses and capital and to connect them to the companies' performances in order to check if intangibility plays a part in the performance level. Then, in a second stage, we will analyze the impact of property structures (cooperatives, unions of cooperatives and other legal structures) on the intensity of the relation between intangibility and performance.

The paper tests empirically the previous relations with the help of an enquiry "*Enquête Entreprises Aval filière Vin – Agro.M – Viniflor, CCVF, EGVF*" carried out by the School of Agronomy of Montpellier (ENSAM) in 2005-2006. This data base gathers questionnaire data and financial statements relating to 214 companies whose activity includes one or more stages in the production and marketing of wine.

We find evidence of a negative impact of intangible proxies on firm economic performance measures and a positive impact on commercial performance for low or medium values of intangible ratios.

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1. Introduction

The objective of this research is to investigate the measurement of intangible expenses and capital and their impact on performance in the French wine industry. Different industries require different measures of intangible capital so we have to construct specific measures of intangibility for the wine industry. Depending on the industry, the various aspects of intangible capital have not the same importance. For example, advertising expenditures are an important source of intangible capital in the distilled beverage and cosmetics industries, research and development expenditures (R&D) are important in the pharmaceutical industry (Megna & Mueller, 1991). Finally the impact of intangibility on performance is also depending on industry (Lev & Zarowin, 1998; Villalonga, 2004, Bobillo et al., 2006).

The French wine industry is worthy of investigation because it has been exposed for some years to the combined effects of globalisation and of exacerbated international competition. So the performance in this industry could depend on intangible investment and this industry has not yet been studied in this context.

Anderson, 2004, among others has pointed out the main characteristics of the globalisation of the wine industry: A tendency for supplies and demand to converge in quality and quantity, a process of internationalisation whereby exports grow much faster than production, a process of consolidation and multinationalisation of companies leading to the emergence of a world oligopoly (Coelho & Rastoin, 2005). These evolutions disrupt the competition environment via strategies of differentiation, policies of massive promotion, and optimisation worldwide of the productivity and logistic chain. In this new context, intangible investment will take an important role in achieving a privileged position in the market (Bobillo et al., 2003).

For the French wine industry, this process of globalisation coming as it does in a context of oversupply that has become structural, offers both threats and opportunities. The major opportunity stems from the growth in foreign markets which offer an alternative to a stagnating, not to say declining, home market. Among other things, threats are due to an extended competition on all market segments, notably that of quality wines which have developed a competitive advantage by implementing efficient commercial policies, as well as competitive costs also related to the size of firms and lighter regulations. It is quite clear that their share of world trade has been growing steadily. In consequence, French wine companies must find ways to defend their competitive position.

To answer to this increasing competitive pressure, French wine companies must adapt their strategy and are doing so. In this study we empirically investigate the question of what firm strategy and characteristics could ameliorate the competitive position of French companies. More specifically we test the claim that intangible investments are major drivers of company performance in this industry as in most economic sectors (Hand & Lev, 2004; Henning et al., 2000).

The remainder of this paper is organized as follows. Section 2 provides theoretical foundations for the existence of a positive impact of intangibility on performance. The methodology for investigating the link between intangibility and companies' performance is described in section 3. In this section is included the description of data and the construction of intangibility and performance measures. Our results are presented in section 4, and section 5 offers conclusion.

2. Intangible capital and performance: theoretical analysis and previous empirical findings

Intangible assets or capital don't have a consistent and generally accepted definition. Hunter et al. 2005; in their review give a negative definition: "any monetary outlays made by the firm in expectation of future profit that are not immediately embodied in tangible form, constitute intangible investment". Four broad categories are often given in literature ⁽¹⁾: human capital, intellectual capital, organizational capital, customer or relational capital. Intangible assets examples as a skilled workforce, patents and know-how, software, strong customer relationships, brands, unique organizational designs and processes, are absorbing a growing part of companies' investment. This raises two questions: how these enormous investments ⁽²⁾ can be structured and measured? Are they valuable? The first question is related to the measurement/accounting literature and will be addressed in section 3. The second one is in the field of strategic management literature which relates intangibility to the process of creating sustainable advantage and corporate value ⁽³⁾. It will be treated below.

¹ The MERITUM-project funded by European Union proposes three categories: human, structural and relational capital.

² Following Lev, 2004, intangible investments absorb a trillion dollars of US corporate investment funds every year.

³ See Arvidsson 2003, for an in depth presentation of these two approaches and their ramifications.

2.1. Intangible assets and competitive position

Two main theoretical approaches can explain the link between intangible investments and firm performance: resource-base view and market orientation (⁴).

First, according to the resource-base view of the firm (RBV), a firm's endowment of resources is what makes its competitive advantage sustainable in time (Wernerfelt, 1984; Rumelt, 1984; Barney, 1996; Dierickx and Cool, 1989, Amit and Schoemaker, 1993; Peteraf, 1993). RBV stresses the importance of intangible resources as the key to sustainability. "... intangible assets, such as a particular technology, accumulated consumer information, brand name, reputation and corporate culture, are invaluable to the firm's competitive power. In fact, these invisible assets are often the only real source of competitive edge that can be sustained over time." (Itami, 1987, p. 1). Intangible resources are typically tacit and hard to codify (Kogut and Zander, 1992; Conner and Prahlad, 1996). There are also likely to trade in imperfect factor markets (Barney, 1996); and exhibit complementarities (Milgrom et al., 1991; Athey and Stern, 1998; Rivkin, 2000). As a result, intangibles are difficult to acquire, develop and replicate within a firm (Itami, 1987; Winter, 1987). For the same reasons, they are also difficult to be understood and imitated by others (Rumelt, 1984; Dierickx and Cool, 1989; Nelson, 1991). These characteristics are what make them valuable and prone to be the basis of a sustainable competitive advantage for a firm (Lipman and Rumelt, 1982; Hall, 1993b). So the main RBV prediction is that the more intangible resources a firm has, the greater the competitive advantage and its sustainability. The impact of intangibility on firm performances is likely to vary across industries for two main reasons. First intangible resources that can be sources of advantage are likely to be of different nature in different industries. Second, the efficacy of different mechanisms for ensuring the appropriation by firms of the value generated by intangible resources is also likely to vary across industries.

Second, marketing literature suggests that long-term success and survival of a company are dependent on its ability to become market rather than product-oriented (Payne, 1988). Market-orientation means that companies develop a distinct organisational culture of shared belief and values (Deshpande & Webster, 1989) and behaviours (Kohli & Jaworski, 1990) that place customer needs at the centre of business decision making. The consequence of this orientation change must be to increase the proportion of investment in intangible assets. In this case, a growing proportion of intangible asset (mainly marketing intangible assets) can be interpreted as the indicator of the adoption of a market-oriented strategy. An effective adoption of market orientation must improve a company's performance relative to its counterparts (Jaworski & Kohli, 1993; Narver & Slater, 1990).

⁴ A third potential theory is the emerging knowledge-base view. The firm can be conceptualized as an institution for integrating knowledge (Grant, 1996). Knowledge creation and application are considered to be the most important source of companies' sustainable advantage.

Intangible assets and performance: previous empirical works

During the last two decades, empirical studies have attempted to find evidence of a positive relationship between intangibility and companies' performance. Two main methodologies can be figured out: studies analyzing the relationships occurring between share returns and investment in intangible assets and research works dealing with relationships between intangible assets and performance measures or competitive advantage. All these studies tend to present ambiguous results on the impact of intangible investments on firm performance especially in the agriculture and food industries.

Studies based upon resources or knowledge based view present, in general, a positive impact of intangible assets on performance. Using a large sample (1992 US listed companies), Villalonga, 2004; confirms the RBV prediction of a positive relationship between intangibility and persistence of the company specific profit for most industries (for instance in the wholesale and retail trade). But for agriculture and food industries results are reversed. In these industries "intangible investment seems a particularly risky strategy..., since it is associated with lower sustainability of competitive advantage but with a no lower (or a higher) sustainability of competitive disadvantage". This last result is coherent with the finding that profitability in the Greek food industry is not merely a consequence of intangible capital (Mavrommati & Papadopoulos, 2005). More generally the impact of intangibility on performance is negative for industries which are labour intensive (Bobillo et al., 2006).

3. Methods

3.1. Sample and data

Data are extracted from the sample "*Enquête Entreprises Aval filière Vin – Agro.M – Viniflor, CCVF, EGVF*" carried out by the School of Agronomy of Montpellier (ENSAM). This data base gathers questionnaire data (214 firms) and financial statements (only 207 over the 214) on firms whose activity includes one or more stages in the production and marketing of wine. The sample, representative of the French wine industry, is divided in 95 limited companies and 94 cooperatives and 18 unions of cooperatives. Table 1 gives the firm distribution by activities. Financial statements are extracted from Diane data base for ten years (1996 – 2006); questionnaire data are concentrated on the years 2003 - 2005.

NAF code	Name	Number of firms	%
011G	Wine growing	12	5.797
159F	Champagnization	22	10.628
159G	Wine making	81	39.131
513J	Wholesale of drinks	91	43.961
702C	Renting of other tangible goods	1	0.483
Total		207	100.00

3.2. Measures of intangible expenses and intangible assets

Currently, there is no standardised and consistent firm measure of intangible capital. Seeing that there is no convergence in the definition of intangibility, measurement methods are

various ⁽⁵⁾, have different purposes and lack of comparability. Two broad approaches are used and often mixed (Hunter et al., 2005): cost based measures and valuation concepts. Trying to reflect management's intent in deciding to allocate expenditures to intangible investment we choose the first approach. The objective is to measure the intangible effort of the company and its consequences on performance. By concern for comparability, reproducibility and interpretability we concentrate on monetary cost measures based on accounting expenses decomposition ⁽⁶⁾. Monetary cost measures have also the advantage to form the basis of a rate of return calculation of intangible investment. As in previous approaches to intangible cost measures we have included stock or flow measures of intangibility.

We calculate five measures of intangibility based upon the decomposition of accounting expenses. Three are proxies of intangible expenses: one measure of total intangible expenses calculated using declarative data, one measure of promotion and publicity expenses using declarative data and one measure of intangible expenses using decomposition of book values. The last two are measures of intangible assets: intangible-in-books and accumulated stock of intangible.

The first ratio can better be described as a non tangible expenses ratio. We consider that grape purchase costs (GPuC), grapes production costs (GPrC) and wine purchase costs (WPC) are only input for the production or commercialisation of wine and therefore are tangible expenses. The remaining of the operating expenses can be tangible or intangible. So the ratio R1 takes the following form:

$$R1a = 1 - \frac{GPuC_{2005} + GPrC_{2005} + WPC_{2005}}{Total\ Operating\ Expenses_{2005}}$$

The higher R1, the higher potential intangible expenses are. In the remaining expenses, amortization expenses are obviously tangible expenses so the numerator is modified to include those expenses ⁽⁷⁾:

$$R1b = 1 - \frac{GPuC_{2005} + GPrC_{2005} + WPC_{2005} + Amt_{2005}}{Total\ Operating\ Expenses_{2005}}$$

The second ratio gives the part of sales dedicated to promotion and publicity expenses. More precisely are included in this category in the questionnaire: discounts (D), promotion and publicity on the place of sale (PPPS), publicity, public relation, communication (PPRC) and others (O). This ratio is declared by the manager in the questionnaire for wines representing more than 25 % of total sales.

$$R2 - b = \frac{D_{2005} + PPPS_{2005} + PPRC_{2005} + O_{2005}}{Sales_{2005}^+}$$

⁵ In a systematic review (Marr et al., 2003) 700 papers were found with issues related to measurement of intangible capital. For other overviews see Rodov & Leliaert, 2002; Hunter et al., 2005.

⁶ We agree with Hunter et al. 2005, when they argue that the use, made by a lot of studies in the field, of a vast array of indicator measures lack these three properties.

⁷ If the declared grapes production cost is correct, amortization expenses of this part of production are double counted.

One can consider that discounts are not an indicator of intangible investment, so we calculate:

$$R2 - n = \frac{PPPS_{2005} + PPRC_{2005} + O_{2005}}{Sales_{2005}^+}$$

Sales+ indicates that only products representing more than 25 % of sales are taken into account. Note that this choice leads to underestimate promotion and publicity expenses (new products take often a large part of these expenses).

We also estimate the amount of expenses in promotion publicity multiplying the above ratios by the turn over (TO) in 2005:

$$R2 - tv = (R2 - b) \times TO_{2005} \quad R2 - v = R2 - n \times TO_{2005}$$

The third ratio is based on book expenses decomposition. This decomposition is detailed in table 2.

Expenses	intangible	tangible	Non affected
Raw material		100 %	
transports		100 %	
Dry goods and packaging	Special calculation explained in appendix 1		
Promotion and publicity	100 %		
Other expenses			100 %
Wages	Special calculation explained in appendix 1		
Amortization depreciation		100 %	

The general form of R3 ratio is the following (⁸):

$$R3_t = \frac{\text{Intangible expenses}_t}{\text{Tangible expenses}_t} \quad \overline{R3} = \frac{\sum_t \text{Intangible expenses}_t}{\sum_t \text{Tangible expenses}_t}$$

t: 2003, 2004, 2005

For the various expenses amount we used two data sources: questionnaire (declared expenses) and Diane data base.

After ratios measuring flux of intangible expenses, we calculate two ratios trying to estimate stock of intangible capital.

The fourth ratio used intangible fixed assets reported in the balance sheet divided by tangible fixed assets reported in the same document:

$$R4 = \frac{\text{Intangible - in - books}_t (IinB)_t}{\text{Tangible - in - books}_t (TinB)_t} \quad \overline{R4} = \frac{\sum_t IinB_t}{\sum_t TinB_t}$$

⁸ Exact denomination of the ratios used in the empirical study is given in appendix 2.

t: 2000, ..., 2005.

Another stock measure of intangibles is constructed using the perpetual inventory equation:

$$K_t = (1 - \delta)K_{t-1} + I_t \quad (1a)$$

$$K_t = (1 - \delta)(K_{t-1} + I_t) \quad (1b)$$

K_t : accumulated stock of intangible assets, (R&D, marketing or both)

δ : constant proportional depreciation rate (⁹),

I_t : Period t investment in intangible assets. Formula (1a) supposes that investment is done at the end of the period, formula (1b) at the beginning of the period. We choose the second hypothesis.

This approach raises two problems, first as stated by Lev & Zarowin, 1998, the choice of the depreciation rate is highly subjective, second we have to calculate the initial stock of intangible assets. Concerning the first difficulty, Hall, 2001, asserts that the choice made upon the depreciation rate does not influence significantly the results as far as the rate stays into the interval [5 %; 20%]. Nevertheless, there is substantial literature that suggests that investment in advertising depreciates more rapidly than investment in R&D (¹⁰). In consequence some studies (Villalonga, 2004,) use different rate for R&D (15 %), and advertising (45 %). To cope with the second difficulty different solutions are suggested: to use expenses of very distant year as the first stock (Villalonga, 2004), or to suppose that company's intangible capital is growing at a constant rate g and to use one of the formulas below (Hall, 1990) (¹¹):

$$K_0 = \frac{I_1}{g + \delta} \quad (2a) \quad K_0 = \frac{1 - \delta}{g + \delta} I_1 \quad (2b)$$

K_0 : accumulated capital at the beginning of the initial year so at the end of previous year (¹²), in our case 2002,

I_1 : intangible investment during the initial year, in our case 2003.

To construct the last ratio (R5) of accumulated intangible capital, we use the same expenses decomposition than the one already done for R3. This decomposition permits to obtain $I_{2003}, I_{2004}, I_{2005}$. To calculate K_{2002} we make 4 assumptions for δ (10%, 15%, 20%, 25 %)

⁹ For a detailed presentation of such an approach one can see the seminal papers of Nerlove & Arrow, 1962; Mansfield, 1968, Schmalensee, 1972; Grabowski & Mueller, 1978.

¹⁰ Mavrommati & Papadopoulos, 2005, Gleason & Klock, 2006, (to cite recent studies) use a depreciation rate for advertising of 30 % for the Greek food industry and the pharmaceutical and chemical industry respectively. Advertising depreciation rates are high and widely spread from about 20 % (Hirschey, 1982) to nearly 100 % (Clarke, 1976; Doroodian & Seldon, 1991), the mean rate seems to be about 50 % (Lambin, 1976; Hirschey & Weygand, 1985).

For R&D standard deviation is less important, a classical rate seems to be 15 % (Griliches, 1981; Hall, 1990; Mairesse & Hall, 1996; Hall et al., 2000, Bobillo et al. 2006). Rates vary from 11-12 % (Pakes & Schankerman, 1986; Nadiri & Prucha, 1996) till 36 % (Pakes & Schankerman, 1986) depending on countries, industries, types of RD...

¹¹ Demonstration in appendix 3.

¹² By convention, year t designates the end of the year.

three of them are inside the recommended interval (¹³) and one is above the interval to take into account the very fast depreciation rate of marketing intangible assets. The growth rate g is calculated starting from the data of our sample. We find a mean growth of intangible expenses (as calculated for R3) of 7.77 % for years 2003-2005. This mean growth rate is very near of the 8 % used in Mueller & Supina, 2002; and Hall, 1990. Then, thanks to the recursion equation (1b) we calculate K_{2005} . The general forms of ratios R5 are then defined as:

$$R5s = \frac{K_{2005} + InB_{2005}}{Sales_{2005}} \quad R5t = \frac{K_{2005} + InB_{2005}}{TinB_{2005}}$$

These ratios measure the importance of intangible capital accumulated scaled by total sales or tangible in books.

3.2. Measures of performance

As our sample is composed essentially of non-listed SMEs we use only book ratios to measure performance. Performance measures are divided in economic and commercial performance. Economic performance is measured by return on assets ratios defined in table 2. Return on asset ratios are preferred to return on equity ratios to remove the impact of the various financial policies and to compare companies with different legal status (private companies and cooperatives). The two different numerators permit to control for arbitrary amortization and depreciation policy (problem of accruals).

Table 3. Return on assets ratios		
	EBITDA (N)	EBIT (N)
Total assets (N or N-1)	P1	P2
Economic assets (N or N-1) = equity + net financial debt	P3	P4

Commercial performance is measured by the gross margin ratio and its variation and growth in sale:

$$P5 = \frac{\text{Value Added}}{\text{Turn Over (TO)}} \quad P6 = \Delta P5 \quad P7 = \frac{TO_N - TO_{N-1}}{TO_{N-1}}$$

We investigate the impact of 2005 intangible expenses or capital on investments on 2006 performances because one can imagine that intangible investments, like all investments, have an impact only on company's future performance.

4. Results

Considering that we have to investigate the relationship between seven ratios of performance measure and more than twenty intangibility ratios and that this multidimensional relationship should not necessarily be linear, we first choose to use essentially Multivariate Analysis of Variance (MANOVA) techniques. Accordingly each intangibility ratio was transformed in a

¹³ Note that 10 % is used by Casta et al. 2005 in a study of intangible capital of European companies.

discrete variable by decomposition in quartiles. We use sales as covariate in order to reduce the size effect. We then conduct a second analysis based on the production function approach.

The relation was first tested using the total sample, and then data were divided into three sub-samples: non-cooperatives, cooperatives, union of cooperatives to study a possible effect of company legal status on results previously obtained.

4.1. Impact of intangibility ratios on performance measures

4.1.1. An exploratory MANOVA analysis

Table 4 summarizes the global effect of each intangible ratio on the seven performance measures. When multivariate relationships are statistically significant we conduct a univariate analysis. If some unvaried links are significant we implement a *post hoc* analysis using Tukey HSD (Honest Significant Difference) test. The results of these tests are given in the last column. For instance R2-v has a significant impact on performance measures and specifically on P5 and P7 (at the 1 % level). For P5 the quartile order is (1, 4, 3, 2) meaning that companies with the lower and higher intangibility ratios have lower P5 ratios.

In general there is a significant multivariate relationship between intangibility ratios and performance measures at the exception of the ratios R1 and R4 (table 4). As it is well known, intangible assets in books (R4) is a poor measure of intangibility, it is probably the same for R1. Impacts are significant principally on performance measures P1, P3 (economic performance ratios), P5 (commercial performance ratio) and in a lesser extend on P4 (economic performance measure with special calculations for the economic asset). The impact of intangible ratios on more dynamic commercial ratios (P6 and P7) is weak. One can observe that ratios measuring more intangible commercial and marketing expenses and effort (R2, R3b, R5b) have a more significant impact on commercial performance (P5, P6, P7) while more balanced ratios (R3n, R5n) have a significant impact on economic performance (table 4).

Table 4. Impact of intangibility on performance ratios			
Method : MANOVA			
Signification: if p < 1 % ***, 1% < p < 5 % **, 5% < p < 10 % *			
Ratio	Multivariate relationship	Univariate relationship	
		Significant impact	Tukey HSD test (5% level)
R1a			
R1b			
R2-tv	***	P5 ***	(1,4,3,2)
R2-v	***	P5 ***, P7 ***	(1,4,3,2) (1,3,4,2)
R3b-05-dec	*	P3*	(4, 3, 2, 1)
R3b-m-dec	***	P3*, P4*, P5***	(4,3,1,2) (3,4,2,1) (1,2,3,4)
R3b-05-db	***	P3**, P4*, P5**	(4,3,2,1) (3,4,2,1) (1,2,3,4)
R3b-m-db	**	P3*, P4*, P5**	(4,3,2,1) (3,4,2,1) (1,2,3,4)
R3n-05-dec	***	P2**, P3***, P4*, P5**, P6**	(4,1,3,2) (4,3,2,1) (4,3,2,1) (1,4,2,3) (4,3,1,2)
R3n-m-dec	***	P3***, P4**	(4,2,3,1) (4,2,3,1)
R3n-05-db	***	P1*, P2*, P3***, P4***	(4,3,2,1) (4,2,1,3) (4,3,2,1) (4,2,3,1)
R3n-m-db	***	P1*, P3***, P4***	(4,2,3,1) (4,2,3,1) (4,2,3,1)
R4			
R5b-s-10	**	P1*, P3**, P4*, P5*	(4,3,1,2) (4,3,1,2) (4,2,3,1) (1,2,4,3)
R5b-t-10	***	P1*, P5***	(4,2,3,1) (4,1,2,3)
R5b-s-15	**	P1*, P3**, P4*, P5*	(4,3,2,1) (4,3,2,1) (4,2,3,1) (1,2,3,4)
R5b-t-15	***	P1*, P5***	(4,2,1,3) (4,1,2,3)
R5b-s-20	**	P1*, P3**, P4*, P5*	(4,3,2,1) (4,3,2,1) (4,2,3,1) (1,2,3,4)
R5b-t-20	***	P1*, P5***	(4,3,2,1) (4,1,2,3)
R5b-s-25	**	P1*, P3**, P4*, P5*	(4,3,2,1) (4,3,2,1) (4,2,3,1) (1,2,3,4)
R5b-t-25	***	P1*, P5***	(4,2,3,1) (4,1,2,3)
R5n-s-10	**	P1**, P2**, P3***, P4**, P5*	(4,3,1,2) (4,3,1,2) (3,4,2,1) (4,3,2,1) (1,4,3,2)
R5n-t-10	**	P1***, P3***, P4*, P5**	(4,3,2,1) (3,4,2,1) (3,4,2,1) (4,1,3,2)
R5n-s-15	***	P1**, P2**, P3***, P4**	(4,3,1,2) (4,3,1,2) (3,4,2,1) (4,3,2,1)
R5n-t-15	***	P1***, P3***, P4*, P5**	(4,3,2,1) (3,4,2,1) (3,4,2,1) (4,1,3,2)
R5n-s-20	***	P1**, P2**, P3***, P4**, P5**	(4,3,1,2) (4,3,1,2) (3,4,2,1) (3,4,2,1) (1,4,3,2)
R5n-t-20	***	P1** P3*** P5**	(4,3,2,1) (3,4,2,1) (4,1,3,2)
R5n-s-25	**	P3***, P5**	(3,4,2,1) (1,4,2,3)
R5n-t-25	***	P1**, P3***, P5**	(4,3,2,1) (3,4,2,1) (4,1,2,3)

Results in table 4 are globally in favour of two conclusions:

- intangibility intensity has a negative impact on economic performance,
- and a positive impact on commercial performance but probably with decreasing returns because companies of the last quartiles (highest intangibility ratio) have often the poorest performance (¹⁴).

These results are coherent with other studies in agro-food sector (Villalonga, 2004; Mavrommati & Papadopoulos, 2005).

4.1.2. Analysis of the relationship between tangibility and performance

Companies with different legal status (non-cooperatives, cooperatives, unions of cooperatives) are often in different businesses; wine makers for cooperative, wine merchants for non-cooperatives and union of cooperatives and have very different objectives (cooperatives are non-profit organization) and governance structures. In each of their businesses they incur different risks, competitive pressure, market conditions... that could

¹⁴ Mavrommati & Papadopoulos, 2005 also find that after a point advertising does not give any bonus to sales.

explain why they obtain different performance. So we can imagine that legal status has an impact on performance and that intangible expense or assets have a differentiate impact depending on the legal status of companies. Trying to verify these hypotheses we conduct MANOVA using sales as covariate to control for a potential size effect.

From table 5 we can see that companies have significant differences in performance mainly due to poor results of union of cooperatives. That could be explained by these companies effective inefficiency or by a value transfer from unions towards cooperatives. Companies also have significant differences in intangible intensities (except for R3 with a narrow definition of intangible expenses). Non-cooperatives and union of cooperatives have more intangible expenses and capital than cooperatives. As expected, wine sellers invest more in intangibles than wine grower or maker.

Ratios	Non-cooperatives	cooperative	Union of cooperatives	Signification p
Sales	24 546	9 507	22 325	0.075
P1 (%)	5.72	5.25	5.04	0.001
P2 (%)	4.23	2.35	-2.21	0.000
P3 (%)	12.10	10.86	2.38	0.272
P4 (%)	9.15	4.41	7.54	0.199
P5 (%)	21.85	17.87	11.35	0.016
P6 (%)	0.72	-0.41	0.55	0.607
P7 (%)	10.82	-0.42	-11.61	0.356
R1a	0.4327	0.3054	0.1035	0.015
R1b	0.4053	0.2554	0.0891	0.013
R2-tv	953.55	282.99	1893.14	0.023
R2-v	505.69	185.54	1171.34	0.007
R3b-05-dec	0.2957	0.1369	0.1885	0.111
R3b-m-dec	0.2370	0.0975	0.3402	0.028
R3b-05-db	0.3227	0.1295	0.3059	0.097
R3b-m-db	0.2245	0.0789	0.3052	0.064
R3n-05-dec	0.1194	0.0634	0.0966	0.057
R3n-m-dec	0.0853	0.0493	0.0776	0.160
R3n-05-db	0.1475	0.0577	0.0833	0.345
R3n-m-db	0.1162	0.0451	0.0731	0.367
R4	0.4569	0.0688	0.2765	0.055
R5b-s-10	0.5247	0.3243	0.5405	0.009
R5b-t-10	18.36	2.43	5.02	0.006
R5b-s-20	0.3043	0.1855	0.3072	0.007
R5b-t-20	10.98	1.39	2.85	0.010
R5n-s-10	0.29	0.1505	0.3275	0.017
R5n-t-10	11.77	1.54	2.40	0.019
R5n-s-20	0.1734	0.0881	0.1886	0.010
R5n-t-20	7.39	0.88	1.36	0.024

Comparison of results in table 4 and 6 does not lead to change our conclusions 1 and 2 on the relationship between intangibility and economic and commercial performances (¹⁵). Table 6 shows the presence of a certain degree of interaction effects meaning that the relationship between intangibility and performance could be influenced by companies' legal status.

To investigate further this influence, the sample was split in three groups each one corresponding to one legal status (table 7). There are significant multivariate relations between intangibility and performance except for unions of cooperatives probably due to the small number of them (¹⁶). The more significant multivariate relations are with cooperatives. Globally our conclusions 1 and 2 are unchanged but we observed interesting difference between cooperatives and non cooperatives. First the impact of intangibility on commercial

¹⁵ Main effects of intangibility ratios on performance are generally less significant.

¹⁶ In consequence we remove the results for unions of cooperative from the table.

performance measure (P5) is unclear for non-cooperatives (remember that they are more intangible intensive). Significant impacts are negative, or have a bell or u shape. For cooperatives the impact is significant and positive on P5 (but negative on P6, the variation of P5). It is quite the contrary for the impact of intangibility on economic performance measures. For non-cooperatives all (with only one exception) significant impacts are negative. For cooperatives the majority of significant impacts are negative but some have a u-shape, meaning that low or high intangibility are associated with higher performance.

Table 6. Interaction between intangibility level and legal status					
Method: MANOVA					
Signification: if $p < 1\%$ ***, $1\% < p < 5\%$ **, $5\% < p < 10\%$ *					
Impact of each intangibility ratio on performance measures: + : positive, - negative					
Ratios	Multivariate relationship		Univariate relationship	effect	interaction
	Main effect	interaction			
R2-tv	***	**	P4**, P5*	(2,4,3,1) (1,4,3,2)	
R2-v	**		P4*, P7*	(2,3,4,1) (1,3,4,2)	
R3b-05-dec					
R3b-m-dec	***	**	P5***	(1,2,3,4)	
R3b-05-db					
R3b-m-db	**		P5**	(1,2,3,4)	
R3n-05-dec		*			
R3n-m-dec	***	***	P4***	(4,2,3,1)	P4***, P5*
R3n-05-db	***	***	P4***	(4,2,3,1)	P4***
R3n-m-db	***	***	P4***	(4,2,3,1)	P4***
R4	***	*	P4**	(1,2,3,4)	P4**
R5b-s-10	*	**	P1*, P7*	(4,3,1,2) (1,2,4,3)	P1*, P4*
R5b-t-10					
R5b-s-20					
R5b-t-20					
R5n-s-10	**		P3**, P4**, P7**	(3,4,2,1) (4,3,2,1) (1,2,4,3)	
R5n-t-10	**		P1**, P2*, P3***, P4***, P5*, P6***	(4,3,2,1) (4,3,1,2) (3,4,2,1) (3,4,2,1) (4,1,3,2) (4,2,3,1)	P4*
R5n-s-20	***		P3***, P4***, P5**, P7**	(3,4,2,1) (3,4,2,1) (1,4,3,2) (1,2,4,3)	
R5n-t-20	**	*	P1**, P2**, P3***, P4***, P6**	(4,3,2,1), (4,3,1,2) (3,4,2,1) (3,4,2,1) (4,2,3,1)	P4*

Table 7. Impact of intangibility on performance differentiated by legal status						
Method: MANOVA						
Signification: if $p < 1\%$ ***, $1\% < p < 5\%$ **, $5\% < p < 10\%$ *						
Impact of each intangibility ratio on performance measures: + = positive, - = negative, u = u-shape, n = bell-shape						
	Multivariate relationship		Univariate relationship		effect	
	Non-coop.	Coop.	Non-coop.	Coop.	Non-coop.	Coop.
R1a				P1**, P3***, P4***		P1-, P4-
R1b		*		P1**, P2***, P4**		P1n, P2-, P4-,
R2-tv	*	**	P5***	P5*, P6*	P5u	P5+, P6-
R2-v	***		P5***, P7*		P5n	
R3b-05-dec		***	P4*, P5*	P1***, P2***, P3***, P4***, P5***	P4-, P5u	P1u, P2u, P3-, P4u, P5+
R3b-m-dec	**	***	P2*, P5*	P5***	P2-, P5u	P5+
R3b-05-db		***	P3*, P4*	P3*, P4*, P5***	P3-, P4-	P3-, P4u, P5+
R3b-m-db		***	P2*	P5***	P2-	P5+
R3n-05-dec	**	**	P2**, P4*, P6*	P3**, P6*	P2n, P4-, P6-	P3-, P6-
R3n-m-dec	**	***	P3*, P4*	P5***, P6***	P3-, P4-	P5+, P6-
R3n-05-db	***	**	P3*, P4*, P5*	P3**, P4*	P3-, P4-, P5-	P3-, P4-
R3n-m-db	**		P3*, P4*, P5*	P3*, P6**	P3-, P4-, P5-	P3-, P6-
R4						
R5b-s-10		***	P1*, P2*, P4**	P1***, P3*, P5*, P7*	P1-, P2-, P4-	P1-, P3-, P5+, P7+
R5b-t-10		***	P5***	P3**	P5-	P3u
R5b-s-20		***	P4**	P1**, P7*	P4-	P1-, P7+
R5b-t-20		***	P5***	P3**	P5-	P3u
R5n-s-10			P2*, P5*	P1**, P3*, P6*	P2-, P5n	P1-, P3-, P6-
R5n-t-10	*	*	P2*, P4*, P5***	P1**, P3*, P6**	P2-, P4-, P5n	P1-, P3-, P6-
R5n-s-20	**	*	P2*, P3*, P4**, P5**	P1**, P3**, P6*	P2-, P3-, P4-, P5n	P1-, P3-, P6-
R5n-t-20	**	*	P1*, P2*, P4*, P5***	P1**, P3*, P6**	P1-, P2-, P4-, P5n	P1-, P3-, P6-

4.2. The production function approach

The general equation used for the production function approach is:

$$Y = f(K_t, K_i, L) \quad (1)$$

where Y is output, K_t is the stock of tangible capital, K_i is the stock of intangible capital and L is labour services. In most studies (¹⁷) on RD efficiency the standard Cobb-Douglas function is used for the function f, equation (1) becomes:

$$Y = AK_t^\alpha K_i^\beta L^\gamma \quad (2)$$

In order to test the previous equation it is useful to take logarithm:

$$\begin{aligned} \ln(Y_n) &= \ln(A) + \alpha \ln(K_{i,n-1}) + \beta \ln(K_{t,n-1}) + \gamma \ln(L_{n-1}) + \varepsilon_n \\ y_n &= a + \alpha k_{i,n-1} + \beta k_{t,n-1} + \gamma l_{n-1} + \varepsilon_n \end{aligned} \quad (3)$$

The coefficients of equation (3) are given in table 8. The coefficients of capital tangible or intangible are not always significant (that is the case for intangible capital measures using a low depreciation rate). They are of the same order of magnitude but quite inferior to the coefficients of labour cost which are highly significant. Table 9 illustrates that the production functions of cooperatives and non cooperatives are very different. Elasticity is positive and

¹⁷ For instance Bobillo et al. (2006).

significant for intangible capital and none significantly different from zero for tangible capital for non cooperative companies. It is just the contrary for cooperatives. The two companies have very different production functions. Cooperative are much more product and production oriented with a great importance given to tangible capital non cooperatives are rather market and distribution oriented with more weight given to intangible capital and labour.

The classical function approach gives precious information on the difference between cooperatives and non cooperatives but its major drawback is that it does not indicate whether intangible investments provide more benefit to the firm than costs. To overcome this drawback we used a modified version of the production function approach first developed by Sougiannis (1994), Lev & Sougiannis (1996), Lev & Zarowin (1998). The function reflects the fundamental relation between the value of corporate assets (tangible and intangible) and the earnings, or operating income generated by them.

$$OI = g(K_t, K_i) \quad (4)$$

OI: operating income.

The variables are scaled by sales to mitigate the econometric problem of heteroscedasticity, due to different sizes of sample companies. The estimated model is:

$$(OI/S)_{in} = a + \alpha(K_i/S)_{in-1} + \beta(K_t/S)_{in-1} + \varepsilon_{it} \quad (5)$$

Results for the coefficients of equation (5) given in table 10 confirm those obtained by MANOVA: the impact of intangible capital on operational performance is negative and significant whatever the measure of tangible capital, intangible capital and operational income. Tangible capital has a significant positive impact on operational performance. These results are unchanged when we split the sample in cooperatives and non cooperatives (table 11). The explanatory power of the model is enhanced for non cooperatives (Adjusted R2 is greater than when we use the total sample).

Table 8 Estimation of the production function					
Standardized coefficients					
Dependent variable : $y = \ln(\text{CA } 2006)$					
Independent variables : $k_t = \ln(\text{the balance sheet value of total asset}), l = \ln(\text{total cost of labor})$					
Independent variable : tangible capital = the balance sheet value of total asset					
	α	β	γ	A	Adj. R2
Ln(ain-b-10) (signification)	0.140 (0.119)	0.107 (0.167)	0.639 (0.000)	3.779 (0.000)	0.608
Ln(ain-b-20) (signification)	0.163 (0.076)	0.113 (0.144)	0.618 (0.000)	3.795 (0.000)	0.611
Ln(ain-n-10) (signification)	0.192 (0.017)	0.116 (0.109)	0.624 (0.000)	3.755 (0.000)	0.641
Ln(ain-n-20) (signification)	0.203 (0.014)	0.120 (0.097)	0.612 (0.000)	3.781 (0.000)	0.643
Independent variable : tangible capital = the balance sheet value of total asset minus the cumulative depreciation					
	α	β	γ	A	Adj. R2
Ln(ain-b-10) (signification)	0.138 (0.143)	0.180 (0.056)	0.549 (0.000)	4.360 (0.000)	0.561
Ln(ain-b-20) (signification)	0.158 (0.099)	0.184 (0.049)	0.531 (0.000)	4.384 (0.000)	0.564
Ln(ain-n-10) (signification)	0.175 (0.041)	0.170 (0.056)	0.557 (0.000)	4.340 (0.000)	0.594
Ln(ain-n-20) (signification)	0.183 (0.036)	0.174 (0.051)	0.548 (0.000)	4.363 (0.000)	0.595

Table 9 Estimation of the production function for cooperatives and non cooperatives					
Standardized coefficients					
Dependent variable : Ln(CA 2006)					
Independent variable : tangible capital = the balance sheet value of total asset					
Independent variable : tangible capital = the balance sheet value of total asset					
	α	β	γ	A	Adj. R2
Ln(ain-b-10)	0.446	0.013	0.433	3.113	0.660
Non Coop.	(0.003)	(0.915)	(0.016)	(0.000)	
Coop.	0.025	0.644	0.294	2.023	0.756
	(0.771)	(0.000)	(0.010)	(0.001)	
Ln(ain-b-20)	0.458	0.019	0.419	3.313	0.664
Non Coop.	(0.003)	(0.880)	(0.019)	(0.000)	
Coop.	0.036	0.646	0.287	2.023	0.756
	(0.678)	(0.000)	(0.012)	(0.001)	
Ln(ain-n-10)	0.260	-0.015	0.660	3.567	0.650
Non Coop.	(0.031)	(0.900)	(0.000)	(0.000)	
Coop.	0.086	0.747	0.146	1.313	0.794
	(0.270)	(0.000)	(0.179)	(0.032)	
Ln(ain-n-20)	0.273	-0.010	0.645	3.613	0.654
Non Coop.	(0.025)	(0.931)	(0.000)	(0.000)	
Coop.	0.093	0.749	0.139	1.318	0.795
	(0.235)	(0.000)	(0.203)	(0.031)	
Independent variable : tangible capital = the balance sheet value of total asset minus the cumulative depreciation					
	α	β	γ	A	Adj. R2
Ln(ain-b-10)	0.438	-0.048	0.436	3.980	0.557
Non Coop.	(0.010)	(0.787)	(0.045)	(0.000)	
Coop.	0.033	0.556	0.346	3.544	0.688
	(0.734)	(0.000)	(0.009)	(0.000)	
Ln(ain-b-20)	0.447	-0.039	0.421	4.172	0.560
Non Coop.	(0.008)	(0.827)	(0.054)	(0.000)	
Coop.	0.043	0.557	0.339	3.548	0.689
	(0.662)	(0.000)	(0.011)	(0.000)	
Ln(ain-n-10)	0.267	-0.061	0.642	4.305	0.545
Non Coop.	(0.058)	(0.733)	(0.002)	(0.000)	
Coop.	0.079	0.568	0.295	3.481	0.692
	(0.411)	(0.000)	(0.025)	(0.000)	
Ln(ain-n-20)	0.273	-0.054	0.630	4.347	0.547
Non Coop.	(0.055)	(0.763)	(0.002)	(0.000)	
Coop.	0.081	0.570	0.292	3.487	0.692
	(0.403)	(0.000)	(0.027)	(0.000)	

Table 10 Impact of tangible and intangible capital on operational income								
Tangible capital : the balance sheet value of total asset / Sales in 2005								
	Dependant variable EBITDA/Sales 2006				Dependant variable EBIT/Sales 2006			
	Intangible capital	Tangible capital	Cste	Adj. R2	Intangible capital	Tangible capital	cste	Adj. R2
R5b-s-10 (signification)	-0.047 (0.003)	0.045 (0.000)	0.037 (0.019)	0.255	-0.022 (0.293)	0.027 (0.033)	0.021 (0.174)	0.092
R5b-s-20 (signification)	-0.078 (0.045)	0.045 (0.000)	0.037 (0.024)	0.25	-0.035 (0.352)	0.027 (0.003)	0.020 (0.200)	0.090
R5n-s-10 (signification)	-0.069 (0.031)	0.044 (0.000)	0.033 (0.023)	0.256	-0.044 (0.153)	0.026 (0.005)	0.022 (0.120)	0.102
R5n-s-20 (signification)	-0.113 (0.046)	0.044 (0.000)	0.033 (0.028)	0.25	-0.068 (0.212)	0.026 (0.005)	0.021 (0.143)	0.097
Tangible capital : (the balance sheet value of total asset minus the cumulative depreciation)/ Sales in 2005								
	Dependant variable EBITDA/Sales 2006				Dependant variable EBIT/Sales 2006			
	Intangible capital	Tangible capital	Cste	Adj. R2	Intangible capital	Tangible capital	cste	Adj. R2
R5b-s-10 (signification)	-0.047 (0.025)	0.076 (0.000)	0.039 (0.005)	0.332	-0.019 (0.334)	0.057 (0.000)	0.013 (0.311)	0.204
R5b-s-20 (signification)	-0.077 (0.035)	0.076 (0.000)	0.038 (0.006)	0.327	-0.029 (0.409)	0.057 (0.000)	0.012 (0.358)	0.202
R5n-s-10 (signification)	-0.071 (0.017)	0.075 (0.000)	0.035 (0.004)	0.336	-0.040 (0.159)	0.056 (0.000)	0.014 (0.221)	0.213
R5n-s-20 (signification)	-0.117 (0.027)	0.075 (0.000)	0.035 (0.006)	0.331	-0.060 (0.231)	0.056 (0.000)	0.014 (0.264)	0.208

Table 11 Impact of tangible and intangible capital on operational income for cooperatives and non cooperatives								
Tangible capital : the balance sheet value of total asset / Sales in 2005								
	Dependant variable EBITDA/Sales 2006				Dependant variable EBIT/Sales 2006			
	Intangible capital	Tangible capital	Cste	Adj. R2	Intangible capital	Tangible capital	cste	Adj. R2
R5b-s-10 Non coop.	-0.069 (0.019)	0.068 (0.000)	0.055 (0.010)	0.417	-0.078 (0.004)	0.056 (0.000)	0.053 (0.006)	0.413
Coop.	-0.081 (0.036)	0.062 (0.000)	0.007 (0.805)	0.237	-0.012 (0.742)	0.037 (0.021)	-0.009 (0.621)	0.071
R5b-s-20 Non coop.	-0.113 (0.027)	0.068 (0.000)	0.053 (0.013)	0.406	-0.128 (0.007)	0.056 (0.000)	0.052 (0.008)	0.399
Coop.	-0.140 (0.041)	0.062 (0.000)	0.007 (0.502)	0.233	-0.017 (0.795)	0.037 (0.021)	-0.009 (0.550)	0.070
R5n-s-10 Non coop.	-0.085 (0.028)	0.067 (0.000)	0.043 (0.017)	0.405	-0.093 (0.010)	0.056 (0.000)	0.040 (0.018)	0.390
Coop.	-0.152 (0.018)	0.060 (0.000)	-0.004 (0.827)	0.256	-0.063 (0.299)	0.038 (0.016)	-0.011 (0.649)	0.090
R5n-s-20 Non coop.	-0.141 (0.040)	0.067 (0.000)	0.044 (0.021)	0.396	-0.156 (0.014)	0.055 (0.000)	0.040 (0.021)	0.378
Coop.	-0.271 (0.020)	0.059 (0.000)	-0.007 (0.783)	0.253	-0.102 (0.355)	0.037 (0.017)	-0.011 (0.519)	0.086
Tangible capital : (the balance sheet value of total asset minus the cumulative depreciation)/ Sales in 2005								
	Dependant variable EBITDA/Sales 2006				Dependant variable EBIT/Sales 2006			
	Intangible capital	Tangible capital	Cste	Adj. R2	Intangible capital	Tangible capital	cste	Adj. R2
R5b-s-10 Non coop.	-0.059 (0.041)	0.088 (0.000)	0.055 (0.007)	0.443	-0.069 (0.004)	0.076 (0.000)	0.052 (0.005)	0.464
Coop.	-0.071 (0.061)	0.081 (0.000)	0.032 (0.129)	0.252	-0.008 (0.742)	0.060 (0.003)	-0.008 (0.665)	0.142
R5b-s-20 Non coop.	-0.095 (0.058)	0.088 (0.000)	0.053 (0.011)	0.434	-0.112 (0.014)	0.076 (0.000)	0.050 (0.007)	0.451
Coop.	-0.113 (0.065)	0.081 (0.000)	0.052 (0.129)	0.250	-0.011 (0.860)	0.060 (0.003)	-0.009 (0.649)	0.142
R5n-s-10 Non coop.	-0.077 (0.041)	0.089 (0.000)	0.046 (0.007)	0.443	-0.085 (0.012)	0.077 (0.000)	0.040 (0.009)	0.454
Coop.	-0.143 (0.023)	0.079 (0.000)	0.030 (0.123)	0.278	-0.059 (0.307)	0.060 (0.002)	-0.004 (0.842)	0.160
R5n-s-20 Non coop.	-0.125 (0.060)	0.088 (0.000)	0.046 (0.010)	0.434	-0.141 (0.020)	0.076 (0.000)	0.040 (0.012)	0.442
Coop.	-0.258 (0.024)	0.079 (0.000)	0.032 (0.113)	0.277	-0.098 (0.358)	0.060 (0.002)	-0.004 (0.534)	0.157

The results of the Cobb Douglas production function are given in tables 8 and 9. For the global sample, coefficients of tangible and intangible capital are significant and of the same order of magnitude but quite inferior to the coefficients of labour cost which are highly significant. Production functions of cooperatives and corporations are very different. Elasticity is positive and significant for intangible capital and negative but none significantly different from zero for tangible capital for non corporations. For cooperatives elasticity of intangible capital is small and positive (non significant) elasticity of tangible capital is high and highly significant. Cooperatives are much more product and production oriented with a great importance given to tangible capital, corporations are rather market and distribution oriented with more weight given to intangible capital and labour. In effect, we can check (table 5) that production function of wholesalers have positive and significant coefficients for intangible capital and negative (non significant) for wine makers.

Results of the modified production function approach (tables 10 and 11) confirm those obtained by MANOVA. The impact of intangible capital on operational performance is negative and significant whatever the measure of tangible capital, intangible capital and operational income. In contrast tangible capital has a significant positive impact on operational performance. These results are unchanged when we split the sample in cooperatives and corporations or in winemakers and wholesalers. The explanatory power of the model is enhanced for corporations and wholesalers (Adjusted R2 is greater than when we

use the total sample). For this two categories the negative impact of intangible on operating income are smaller than for cooperatives and wine makers.

5. Conclusion

We find concordant evidences of a negative impact of intangibility on companies' economic performances measures and of a positive impact for commercial performance measures. This result can have many explanations.

First our results are subject to measurement error of intangibility and performance and are incomplete due to the fact that the relationship between intangibility and performance is complex and depends on various characteristics of companies which can't be reduced to size or legal status. For example we don't take into account the risk dimension. It could be rational to invest in assets with negative impact on performance if these assets reduce the risk of the company by stabilizing cash flows.

Second, negative relationship between intangible expenses or capital and performance can be explained by the fact:

- That companies with poor performances try to reduce their competitive disadvantage by investments in intangible assets,
- Intangible expenses are not intangible investment meaning that these expenses made by companies with a product-orientation tradition are not effective and intangible investments are wasted. Because intangible necessitate dramatic change in companies' organization, management, control and culture, it takes time to be used efficiently. Intangible investments are subjected to a learning phenomenon.

Third, following a risk management approach we could say that intangible assets are used in an effective way because they reduce profit expectation but also profit risk and downside risk (Amadiou and Viviani, 2008).

Appendix 1. Expenses decomposition between tangible and intangible for dry goods and wages

Dry goods

We suppose that, beyond a minimum cost, packaging expenses can be considered as a way to promote the product and so are intangible. For every company, we know the decomposition of the wine sold in bulk, bottle and other conditionings (bag in box ...) for the year 2005. We first verify that conditionings expenses (CE) can be explained by the volume of wine in bottles (B). We run two OLS and obtain the following result:

$$CE_i = 0.0671B_i \quad R^2 = 0.8126 \quad (1)$$

$$CE_i = 0.0675B_i - 0.0018OP_i \quad R^2 = 0.8041 \quad (2)$$

OP_i : bag in box and other packaging expenses

Considering the two coefficients of determination and the negative coefficient for bag in box, we conclude of a quite good determination of conditioning expenses by volume of wine in bottle only.

We then calculate the volume in bottles 2004 and 2003 supposing a constant proportion with sales. For every company we calculate the ratio conditioning expenses/ volume in bottles. We take the mean of the first quartile of this ratio as the basic conditioning expenses: 0.1916 €/l in 2005, 0.1674 €/l in 2004 and 0.1392 €/l in 2003. Conditioning expenses above this value are considered intangible.

Wages

Wages are decomposed in tangible and intangible expenses using the ventilation of employees (given in the questionnaire) in seven different functions.

First we try to estimate the wage mean by function using the following OLS model:

$$W_i = \sum_i^7 w_i e_{ij} + \varepsilon_j$$

W_j : total wages of company j,

e_{ij} : number of persons of the company j employed in function i,

w_i : estimated wage for function i,

ε_j : residual for company j

The results are given in table A1.1.

Table A1.1. Estimated wages for the different functions (in €/year)	
1 Production and conditioning	32 204
2 Commercial France	27 308
3 Commercial Export	88 867
4 Sales administration	86 082
5 General administration and finance	50 178
6 Marketing	136 768
7 Quality and RD	33 083
Coefficient of determination R2	0.95

Second we make two different assumptions on the intangibility of wages expenses:

- Broad wages intangibility expenses: total wages less wages of functions 1 and 5 are considered intangible,
- Narrow wages intangibility expenses: only wages of function 6 and 7 are considered intangible.

Appendix 2. Ratio denomination

The various ratios R3 are synthesised in table A2.1.

Table A2.1. Ratios R3			
Declared (dec)/data base (db)		Period	
		2005	Mean of 2003-2005
Intangibility expenses	Broad (b)	R3b-05-dec / R3b-05-db	R3b-m-dec / R3b-m-db
	Narrow (n)	R3n-05-dec / R3n-05-db	R3n-m-dec / R3n-m-db

Ratio R5 are all constructed on the same sheme: R5x-y-nm
X: broad (b) or narrow (n) definition of intangible expenses,
Y : denominator is sales (s) or tangible in books assets (t)
Nm : value of δ , 10 meaning 10 %.

Appendix 3. Simplified formula for accumulated capital

We only make demonstration for formula (2a), formula (2b) is very easily obtained multiplying by $(1 - \delta)$.

From equation (1a) in text lagged of one period we can write:

$$K_{t-1} = I_{t-1} + (1 - \delta)I_{t-2} + (1 - \delta)^2 I_{t-2} + \dots$$

Using the fact that intangible investment grows at a constant rate g, it comes:

$$K_{t-1} = \frac{I_t}{(1+g)} + \frac{(1-\delta)}{(1+g)^2} I_t + \frac{(1-\delta)^2}{(1+g)^3} I_t + \dots$$

The infinite sum of a geometric infinite series is: $K_{t-1} = \frac{I_t}{(1+g)} \frac{1}{1-\frac{1-\delta}{1+g}} = \frac{I_t}{g+\delta}$.

We obtain the formula (2a) given in the text.

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