Wood-harvesting enterprise financing and investment

Markku Penttinen

University of Gävle
SE-80176 Gävle
Sweden

Jarmo Mikkola and Arto Rummukainen

Finnish Forest Research Institute
Pl 18
FI-01301 Vantaa, Finland

Abstract

Large Finnish forest industry companies want to increase the size of their harvesting service enterprises after the extremely low industry production volumes in 2009. This has required harvesting enterprises to grow. However, profits in this small and medium size enterprise business have been low, especially since the 2009 downturn. Thus there has been only limited potential to grow organically. Other possibilities are to organise cooperation in the main - subcontractor base or to network to establish a limited company owned by independent entrepreneurs to make agreements with customers.

The harvesting enterprises and their growth opportunities were analysed by statistical methods using the tax authority data of about 1000 enterprises for the 2001–2008 closing of the books. The usability of all applicable ratios was tested, and results were produced in the form of tables and figures. The closing of the books data from 2008 was analysed, revealing interesting relations and eight independent factors which describe success and failure factors. Recommended ratios were defined for the analysis of the whole wood-harvesting sector and for researching individual enterprises.

Keywords

Ratio analysis, SME enterprise, wood harvesting, growth, financing

Preface

What is the role of research findings in SMEs? While remarkable developments have taken place in wood harvesting technology, this has not inspired knowledge and management skills in SMEs very much. Research is of great relevance in developing the management practices of SMEs, however, especially because forest industries will negotiate with bigger so-called key or area enterprises. A special feature of the wood-harvesting business is its substantial investment and consequent the need for financing when buying harvesters and forwarders. This makes the planning and management of investment and financing of primary importance.

This study covers the whole wood-harvesting sector. The empirical evidence is based on the closing of the books of all enterprises, which have supplied their annual reports to the taxation officials. The first step in finding the material was to define every relevant machine type, including their product codes. Every relevant machine was then searched for in the databases of the Finnish Transport Safety Agency (Trafi). At the same time, even owner and enterprise information was delivered by Trafi. Thereafter, machines older than 15 years as well as owners who were not in the wood-harvesting business were excluded manually. The resulting enterprise and personnel numbers were used to find the closing of the books in the databases of Statistics Finland. This search produced enterprises with only turnover information, but most enterprises had supplied the information required for the analysis The statistical analyses and the information for tables and figures were conducted in the laboratory of Statistics Finland. The scientific methods used are those of accounting, especially those of ratio analysis and forest technology. The statistical methods applied were those of descriptive statistics as well as correlation, principal component and factor analysis.

Acknowledgements
The opportunity to obtain enterprise and entrepreneur data on all wood-harvesting machine types provided by Trafi is gratefully acknowledged. Without their data, the research would not have been possible. The use of databases and the laboratory of Statistics Finland was the core of the study. The technical and other support from Statistics Finland experts enabled efficient research.

The research was conducted as part of the Finnish Forest Research Institute project 3454 “Profitability development of the service business of wood procurement enterprises” and thereafter at the Department of Business Studies of the University of Gävle. The authors gratefully acknowledge the opportunity to put their effort into this research.

This research has been financed by the Finnish Cultural Foundation and the Marjatta and Eino Kolli Foundation, which are gratefully acknowledged. The language was checked and improved by Dr. Roderick McConchie, University of Helsinki, Department of Modern Languages. The authors hope that this research

provides both a scientific contribution and findings of use to the wood-harvesting business.

Gävle in Sweden and Vantaa in Finland, September 30, 2011

Markku Penttinen Jarmo Mikkola Arto Rummukainen

Contents

Preface 7

1. INTRODUCTION 1
   1.1 Why ratio analysis? 1
   1.2 Ratio analysis classifications 2
   1.3 Statistical properties of financial ratios 4
   1.4 Phases of ratio analysis 5
   1.5 Problems and limitations of ratio analysis 5
   1.6 Financing of wood-harvesting enterprises 6

2. RATIO ANALYSIS METHODS 8
   2.1 Ratio analysis traditions 8
   2.2 The du Pont pyramid 8
   2.3 Investment, spread, weighted average cost of capital (WACC) and economic value added (EVA) 10
   2.4 Correlation 10
   2.5 Factors and ratios 11
   2.6 Economies of scale and the debt level 13

3. PURPOSE OF THE STUDY AND HYPOTHESES 14

4. DATA 15
   4.1 Key features of the wood-harvesting business 15
   4.2 Accounting material 18

5. FINANCIAL ANALYSIS RESULTS 21
   5.1 Profitability of wood-harvesting business 21
   5.2 Financial adequacy 26
      5.2.1 Debt burden 27
      5.2.2 Investments and reserves 32
      5.2.3 Liquidity and survival times 39
   5.3 Capital structure 45

6. STATISTICAL ANALYSIS 52
   6.1 Relevant and irrelevant variables 52
   6.2 Correlation 53
   6.3 Principal component and factor analysis 54

7. CONCLUSIONS 58

LITERATURE 63

Figures

Figure 1. The Du Pont return on investment formula (cf. Johnson and Kaplan 1987) 9
Figure 2. Impact opportunities in the logistic contribution (Stapleton et al. 2002) 12
Figure 3. Development of productivity of harvesting work calculated by cubic metres harvested divided by number of workers from 1970 to 2007. Harvesting consists of felling, delimbing, cross-cutting and transport from stump to roadside. Data source: Finnish Statistical … 2010.....17
Figure 4. Cost structure of forest machine business from 2005 to 2009 according to Statistics Finland forest machine cost index (Metsäalan konekustannusindeksi ... 2010). 17
Figure 5. Profit before tax for Finnish forest companies in from 2000 to 2008 (Forest Industries 2011). 18
Figure 6. Number of wood-harvesting enterprises from 2001 to 2008 in Statistics Finland (2009) data. The differences are due to the limitations in the closing of the books data used for ratio analysis. 19
Figure 7. Average turnover of harvesting enterprises from 2001 to 2008 in Statistics Finland data (2009). The differences are due to the limitations in the closing of the books data used for ratio analysis. 20
Figure 8. The medians of the net result in percentages by enterprise turnover class from 2001 to 2008 for some 1050 enterprises. Entrepreneurs' own salary reduction according to the Statistics Finland rules. 22
Figure 9. The medians of the net result in percentages by enterprise form class from 2001 to 2008 for some 1050 enterprises (figure 6). Entrepreneur's own salary reduction according to the Statistics Finland rules.....23
Figure 10. The lower quartile, median and upper quartile of net result (in percentagesWouldn't '%' be simpler?) of harvesting enterprises in turnover classes in 2008. Entrepreneur's own salary reduction according to the Statistics Finland rules.....24
Figure 11. The lower quartile, median and upper quartile of net result (in percentages) for some 1050 harvesting enterprises in turnover classes in 2008. Salary reduction of 20,000 € or 30,000 € has been applied to person and partnership enterprises (see text in previous chapter).....25
Figure 12. Cost structure of forest machine business from 2001 to 2008 according to Statistics Finland accounting data (2009). 26
Figure 13. The median and lower and upper quartiles of repayment period by turnover class in 2008. 27
Figure 14. The lower quartile, median and upper quartile of the interest expense coverage ratio in 2008. 29
Figure 15. Medians of financing expense related to operating margin by turnover class from 2001to 2008. 30

Figure 16. Lower quartile, median and upper quartile of financial expense rate by turnover class 2008. 31
Figure 17. Medians of financial expense rate by turnover class from 2001 to 2008 31
Figure 18. The lower quartile, median and upper quartile of gross investment by turnover class in 2008 32
Figure 19. The lower quartile, median and upper quartile of gross investment related to turnover by turnover class in 2008 33
Figure 20. The medians of gross investment related to turnover by turnover class from 2001 to 2008 34
Figure 21. The lower quartile, median and upper quartile of the equity financing share of investment by turnover class in 2008 35
Figure 22. The lower quartile, median and upper quartile of the financial reserve by turnover class in 2008 36
Figure 23. The medians of the financial reserve by turnover class in from 2001 to 2008 36
Figure 24. Medians of financial reserve in proportion to the financing result by turnover class from 2001 to 2008 37
Figure 25. Lower quartile, median and upper quartile of financial reserve related to financing result by enterprise form in 2008 38
Figure 26. Medians of financial reserve related to financing result by enterprise form in from 2001to 2008 39
Figure 27. The lower quartile, median and upper quartile of quick ratio by turnover class in 2008 40
Figure 28. The medians of quick ratio by turnover class from 2001 to 2008 40
Figure 29. The lower quartile, median and upper quartile of cash ratio by turnover class in 2008 41
Figure 30. The lower quartile, median and upper quartile of the survival times when fixed expenditures, financing expenses, salaries and amortization of short-term debts are paid based on the closing of the books in 2008 43
Figure 31. The lower quartile, median and upper quartile of the survival times when fixed expenditures, financing expenses, living expenses and amortization of short-term debts but no wages are paid based on the closing of the books in 2008 44
Figure 32. The lower quartile, median and upper quartile of the survival times when only fixed expenses, financing expenses and the amortization of short-term debts are included based on the closing of the books in 2008 44
Figure 33. The lower quartile, median and upper quartile of the net debt ratio by turnover class in 2008 45
Figure 34. The median of the net debt ratio by enterprise turnover class from 2001 to 2008 46
Figure 35. The lower quartile, median and upper quartile of the equity ratio by turnover class in 2008 47
Figure 36. The lower quartile, median and upper quartile of the equity ratio by enterprise form in 2008 48

Figure 37. The medians of net gearing by turnover class from 2001 to 2008 49
Figure 38. Lower quartile, median and upper quartile of asset turnover ratio by turnover class in 2008 50
Figure 39. Medians of net working capital by turnover class from 2001 to 2008.....50
Figure 40. The financial leverage ratio by turnover class 2008.....51

Tables

Table 1. Comparison of the classifications of financial ratios in selected studies.....3
Table 2. Correlations between success variables and other ratio variables by using the closing of the books data in 2008. 53
Table 3. The principal component analysis solution of a wood-harvesting enterprise using the closing of the books data in 2008.....54
Table 4. The factor analysis solution of wood-harvesting enterprise using the closing of the books data in 2008. 55

Formulas

Formula 1. Return on equity (ROE) broken up into profit margin, capital turnover and financial leverage

1. INTRODUCTION

1.1 Why ratio analysis?

Accounting is the most common control tool used by enterprises and is compulsory even in small and nedium mized enterprises (SMEs), other than the smallest individual enterprises. To increase the relevance of the accounting information, one must analyse it more thoroughly by using ratio analysis, which forms part of a management control system (Amigoni 1978). The efficient-market hypothesis (EMH) asserts that financial markets are in theory "informationally efficient", or that prices on traded assets already reflect all known information (Fama 1970). Thus it would be impossible to consistently outperform the market by using any information that the market already knows which would limit the motivation of ratio analysis in the case of enterprises with traded stocks.

However, financial ratio analysis can be potentially useful in other respects:

(i) Some markets may not be efficient.

(ii) Financial reports and accounting ratios provide information to an external audience such as banks before loan decisions are taken.

(iii) Ratio analysis may assess the contributory risk (Patton 1982), which has motivated a host of bankruptcy studies taking this approach.

There is in fact a long tradition of research on financial ratios as predictors of takeovers (Belkaoui 1978) and failures such as bankruptcy (Laitinen 1991). In the case of the SMEs, financial reports may be the only external information they provide. However, the observed lack of association between the utilisation of financial ratios and either the survival or profitability of small business may also indicate that the level of sophistication in the use of ratios is not yet high enough. The ratio analysis is conducted on a piecemeal and ritualistic basis and thus not as a systematic evaluation of past performance (Thomas and Evanson 1987). Surprisingly, there appears to be no statistically significant correlation between achieved rates of growth in turnover, employment, and net profit and use of financial ratio analysis (McMahon and Davies 1994). Moreover, empirical evidence suggests that financial ratios are not an effective means of detecting fraud (Guam et al. 2001). Additionally, empirical evidence from Finnish companies suggests that the efficiency improvement strategy and the marketing improvement strategy generally seem to be the best adaptation strategies in the long term (Laitinen 2000).

In all, there are two principal reasons for using ratios:

(i) To control for the effect of size on the financial variables being examined

(ii) To control for industry-wide factors.

Ratios aid comparisons between a subject firm and its industry (Barnes 1987). Moreover, ratio analysis can be used to achieve optimal financing policies, the question of which has been inspired by the trade-off theory (Fama and French 2002) and the pecking-order theory of capital structure (Myers and Majluf 1984).

1.2 Ratio analysis classifications

Financial ratio analysis can be classified by applying different approaches:

(i) Pragmatic empiricism is a subjective classification found in text-books.

(ii) The deductive approach goes back to the 1919 du Pont triangle system splitting profits/total assets (depicted in James 1923).

(iii) The inductive approach relies on the empirical evidence and applies such things as factor and regression analyses.

(iv) The confirmation approach hypothethises an a priori classification and then tries to confirm this classification using empirical evidence (Salmi & Martikainen 1994).

Recall that the objective of a company is to maximise its shareholders' wealth in the spirit of von Neumann and Morgenstein's modern axiomatic utility theory (1944), but not net profit. The wealth maximisation and the du Pont triangle have inspired a strategic profit model in which return on net worth is a function of net profit, asset turnover and financial leverage (Stapleton et al. 2002). In practice, however, the financial goal is economic value added (EVA) rather than net profit (Slater and Olson 1996). In all, the literature and research on financial ratios has evolved in two main directions: testing and developing theoretical ratio structures and limiting the number of ratios used (Ali & Charbaji 1994).

Ratio groupings

Profitability ratios undoubtedly are the most important ratios in financial statement analysis although liquidity ratios have a longer history because of the credit-oriented early phases of financial analysis (Horrigan 1968). Other categories of

accrual ratios include liquidity, capital adequacy (solvency), efficiency, operating leverage, riskiness and volumes (Salmi et al. 1990) (table 1).

Table 1. Comparison of the classifications of financial ratios in selected studies

Study	Profitability	Short-term liquidity I	Short-term liquidity II	Capital adequacy	Efficiency	Leverage
Martikainen et al. (1995)	Profitability	Cash flow	Short-term solvency	Long-term solvency		
Martikainen (1992)	Profitability	Cash flow	Liquidity	Financial leverage	Efficiency	
Kanto & Martikainen (1991)	Profitability		Liquidity	Financial leverage	Efficiency	
Salmi et al. (1990)	Profitability		Short-term liquidity	Long-term solvency	Efficiency	Operating leverage
Yli-Olli & Virtanen (1985)	Profitability		Short-term solvency	Long-term solvency	Efficiency	
Drury (1981)	Return on investment ratios	Acid test (quick ratio)	Short-term solvency: current ratio	Debt to eq., interest rate coverage		
Aho (1980)	Profitability		Liquidity	Financial investment opportunities	Working capital turnovers	
Courtis (1978)	Profitability	Short-term liquidity, cash flow		Long-term solvency	Managerial performance inventories, asset-equity structures	
Fadel & Parkinson (1978)	Profit as a percentage of capital employed	Cash flow to interest exp., working capital to capital empl.		Debt to total equity, cash flow as a percentage of total debt		
Lev (1974)	Profitability ratios		Liquidity ratios	Long-term solvency ratios	Efficiency (turnover) ratios	

The profitability group could consist of return on (total) assets (ROA), operating margin to sales and net income to common equity (return on equity, ROE). The short-term liquidity group includes quick ratio (roughly cash/short-term liabilities), repayment period of debts and financing of investment. Long-term solvency or the capital adequacy group consists of long-term debt to equity and total liabilities to sales, as well as times interest earned (earnings before interest and taxes plus depreciation / interest), the last of which represents interest cover. (Salmi et al. 1990, CCA 2000). Note that interest cover, total debt and long-term debt to daily cash flow outperformed other liquidity ratios according to Fadel and Parkinson (1978).

The efficiency (turnover ratios) such as the inventory turnover period and the accounts receivable turnover period cannot be estimated with the available empirical evidence, which consists the closing of the books of roughly 1050 enterprises for nine years. Moreover, the inventories are not relevant in the service business. However, the operating leverage group consists of such ratios as labour intensive-

ness (personnel expenditure / adjusted real-term fixed assets) and variable costs/fixed costs, as well as volumes such as growth rate and size (a firm's total assets in proportion to the largest firm) (Salmi et al. 1990) might be relevant even in a service business. Moreover, the idle capacity ratio, depicting operational efficiency, and asset turnover, depicting profitability, have also been relevant in SMEs (Sabri 1998). Recall that a number of combined ratios such as an aggregation of the receivable, inventory and account payable turnover ratios has been proposed under the name merchandising ratio (Cote and Latham 1999). In all, desirable ratios for a firm are those which result from that firm following the most desirable policies for its own specific circumstances (Bird and McHugh 1977).

1.3 Statistical properties of financial ratios

Financial ratios follow a multiplicative rather than an additive law of probabilities (McLeay and Trigueiros 2002). They may have an additive or multiplicative error term, an intercept, dependence on other variables and non-linearity. Basic questions involve control of company size and/or other industry-wide factors in the analysis such as the structural relationship between the ratio examined and company size in the form of turnover. Moreover, spurious correlation may emerge as a result of size deflation, which means that correlation between two variables x and y is not, in general, equal to the correlation between the ratios x/z and y/z, e.g., in the case of ratios with common denominators (Lev and Sunder 1979). On the other hand, 'the purpose of financial ratios is not to provide information about ratios' components' (Horrigan 1983). The widespread lognormality of raw accounting numbers implies a positive skewness. The existence of symmetry and negative skewness is explained as the effect of external boundaries such as accounting identities (Trigueiros 1995).

Financial ratios may typically have unusual properties for three reasons (Laitinen 2002, 37):

(i) Neither numerator nor denominator can have negative values, which causes skewness in the distribution of the ratio.

(ii) The denominator has values which are close to zero.

(iii) The numerator and denominator change at the same time.

Financial ratios follow a multiplicative rather an additive law of probability, multiplicative behaviour of ratio components also being a prerequisite of valid ratio usage. Moreover, multiplicative ratios are governed by proportionate or ex-

ponential growth. Multiplicative variables tend to be lognormally rather than normally distributed (McLey and Trigueiros 2002).

1.4 Phases of ratio analysis

The development of ratio analysis may consist of the following phases:

(i) Find the key element in companies which causes changes in financial health,

(ii) Select criteria for ratios with the highest predictive power.

(iii) Choose the ratios.

(iv) Explain the development with the help of a worked example (cf. Robertson 1983).

Typically there are two main phases: first the selection of the ratios and, second, their empirical testing and interpretation (Salmi et al. 1990), which are actually repeated in practice.

1.5 Problems and limitations of ratio analysis

Although ratios usually measure changes in the financial health of companies well, there are problems and limitations such as:

(i) Ratios have been developed on a piecemeal basis.

(ii) The values of liquidity ratios have been falling in companies.

(iii) No 'rule-of-thumb' applies to all companies.

(iv) Some of the key ratios are misleading.

(v) It is difficult to interpret (a) movements in single ratios and (b) movements in a number of ratios.

(vi) Popularity reduces a ratio's usefulness (Robertson 1984).

1.6 Financing of wood-harvesting enterprises

Modern wood harvesting with machines started in the Nordic countries in the 1960s. Previously, a farmer worked with his horse in the forest during winter, when there was no actual farm work. At the same time as they first bought farm tractors and later special forest tractors, the harvesting became a year-round job. The last of the first generation of full-time mechanised harvesting entrepreneurs are now retiring. Even from beginning of mechanisation, the machines were mostly owned and operated by private entrepreneurs. During the development phase, forest industry and machine vendor companies paid part of the development cost.

During the 1970s and 1980s, there was a procurement contract system which was based on the negotiations between the wood-harvesting entrepreneur organisation and the forest industry organisation (Hakkila et al. 1989, Mäkinen 1996). The forest industry's work study organisation, later Metsäteho Oy (2011), conducted time studies in the field and determined productivity levels for mechanical cutting and forwarding, which were then used as the basis of the negotiations. The organisation level negotiations had to be cut short because they were in conflict with European Union competition regulations (Rumpunen 1996). Since then, each entrepreneur has negotiated his own contracts with industrial customers. State Forests [officially Metsähallitus] concludes contracts with the successful tenderers. In most cases, the customer has much more negotiation power than the entrepreneur (Alajoutsijärvi et al. 2001). All larger customers also have their own scaling and data transfer systems, which prevents entrepreneurs from serving several customers at the same time.

The economics of the wood-harvesting business has been monitored by their own association (The Trade Association... 2011) and OP-Pohjola Bank Group (Turkulainen 2009). Mäkinen (1988, 1993) in Finland, Norin & Thorsen (1998) in Sweden and Dale (1993) in Norway have looked for the success and failure factors in the wood-harvesting business mostly on the basis of economic indicators. Profits have been moderate to poor over the years (Mäkinen 1988, 1993, Dale 1993, Rajamäki & Heikka 1990, Väkevä & Imponen 2001, Pekka 2008). The percentage of debt to turnover has been also been high.

In Europe, the operational structure of the forest-harvesting business varies a lot. In Northern Europe, the work is mostly fully mechanised, whereas in Eastern Europe it is more labour intensive. Most entrepreneurs cope with the poor profitability of the business, however (Rummukainen et al. 2006).

The year 2007 was a record high harvesting year in Finland, 58 million cubic meters domestic wood being harvested (Finnish Statistical ... 2010). The economic recession then hit the forest industry hard, with the harvesting volume falling to 51 million in 2008 (Finnish Statistical ... 2010) and to 41 million in 2009 (Metinfo Forest Statistics 2011). This caused months of shutdowns both in the mills and the harvesting machine companies. As a result, both turnover and profits of harvesting enterprises decreased (Kakoyi 2010).

During the recession, large industrial customers decided to renew their wood procurement organisations by making them leaner and accordingly preferred harvesting agreements with bigger enterprises. It was left to the entrepreneurs to decide whether they would grow naturally by buying new machines or enterprises or whether they would join other entrepreneurs in forming a new "umbrella" enterprise when making agreements with the customers. Nowadays forest harvesting agreements are based on tender competition as they previously were only with State Forests. Pressures for structural change and the new negotiation systems after a very poor economic period have put entrepreneurs in a difficult situation. There is a need to grow, but this requires investment, which is difficult following the recession.

The forest industry has also investigated the potential of an organisation model called diversified independent contracting (Rekilä & Räsänen 2008) to identify ways to promote the growth of harvesting enterprises. Soirinsuo & Mäkinen (2009a and b, 2010) have studied the growth potential and prerequisities of wood-harvesting enterprises, finding that successfully growing entrepreneurs are innovative and proactive and plan growth carefully. This requires exact knowledge of their own enterprise's economic situation and careful investment calculations. In Finland, the combined depreciation and interest costs have taken up the second largest proportion of turnover after salary costs (Metsäalan konekustannusindeksi ... 2010). Work volumes vary seasonally and economic trends add more variation between years. It is difficult to overcome work volume variation with permanent personnel. One solution is to have part-time entrepreneurs, who have been researched by Mäntynen (2009).

Harvesters and forwarders are usually the only assets of a wood-harvesting entrepreneur. Machines usually have to be exchanged for new ones after every three to five years and they can hardly be utilised in any other business. This makes the investment decisions crucial for an entrepreneur.

2. RATIO ANALYSIS METHODS

2.1 Ratio analysis traditions

The roots of financial statement analysis can be traced back to the latter half of the nineteenth century, and credit analysis, in terms of the firm's ability to repay its debt, was the focal point of the analysis (Ali and Charbaji 1994). Indeed, the financial ratios were originally developed as short-term analytic devices (Horrigan 1965), and the first coherent system of ratios was published by James in 1923.

Ratio analysis and its interpretation may differ considerably from country to country, as in the U.S. as against Korea and Japan (Choi et al. 1983). Moreover, the use of financial ratios disclosed in annual reporting are likely to be misleading, because of differing applications of accounting principles and different numerator/denominator component selections (Courtis 1996). The use of financial ratios has recently been extended to testing of even more critical relationships between financial, environmental and social performance (Castro and Chousa 2006).

2.2 The du Pont pyramid

The starting-point for a systematic analysis of a firm's performance is its return on equity (ROE) defined as ROE = net profit / shareholders' equity (Palepu et al. 2007). Unfortunately, the equity of small and medium sized enterprises (SMEs) is often a very ill-defined item. Moreover, when the debt load of the enterprise is heavy, financial leverage forces the ROE to over-react both in good and bad times. The ROE is affected by the return on assets (ROA) and the amount of assets related to shareholders' equity i.e., ROE = ROA * financial leverage = (net profit/assets)*(assets/equity). ROA indicates how much profit can be generated per euro of asset invested, and can actually be used as a base ratio even in the SMEs.

The du Pont pyramid technique, starting with return on net worth (= return on equity, ROE), has commonly been applied to ratio analysis. Profit divided by total assets (ROA) generates profit margin and capital turnover components, which split into further components (figure 1).

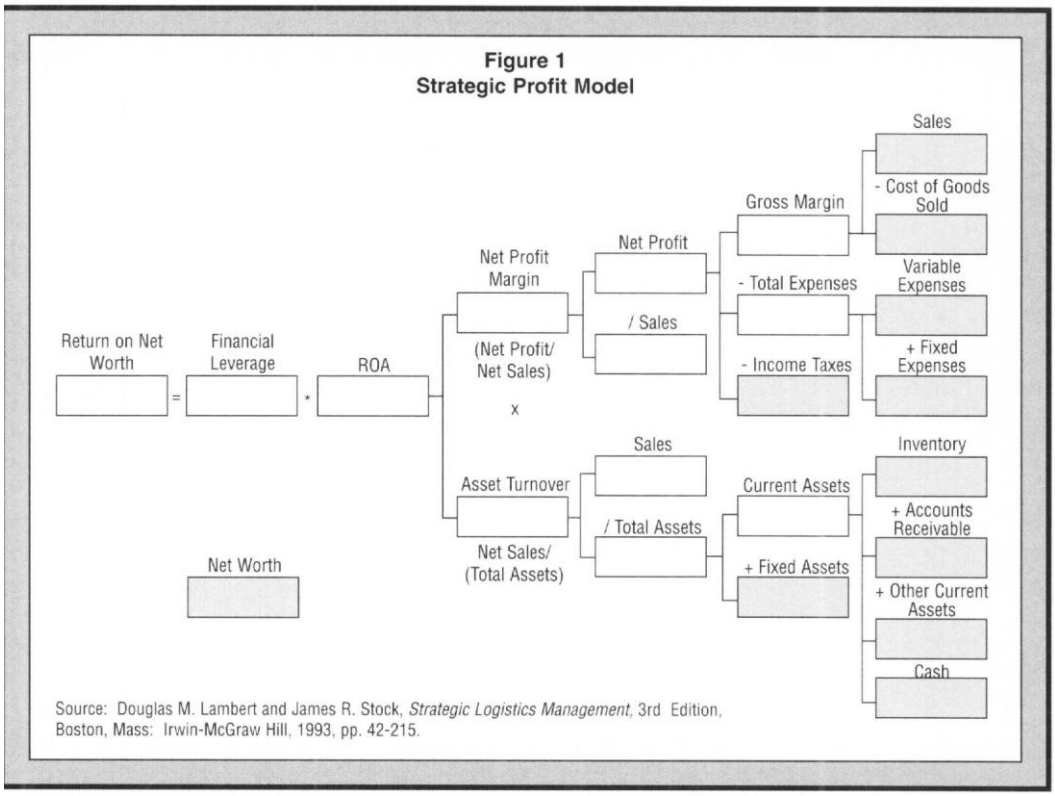

Figure 1. The Du Pont return on investment formula (cf. Johnson and Kaplan 1987)

However, the du Pont pyramid approach is methodologically suspect since, when differences in higher--level ratios are explained by differences in the lower ones, it can be shown to be potentially misleading (Bayldon et al. 1984). Moreover, this well-known triangular relationship between profit margin, turnover and return on assets did not appear when investigating ratios by factor analysis (Ali and Charbaji 1994).

This calculation of return on equity (ROE) can be broken up into three separate ratios as follows (cf. de Wet and du Toit 2007: 60):

Formula 1. Return on equity (ROE) broken up into profit margin, capital turnover and financial leverage

ROE = [Net results / Turnover] * [Turnover / Assets] * [Assets / Equity]

= [Profit margin] * [Capital turnover] * [Leverage]

The first term represents profitability, which has been considered in Penttinen et al. (2009a) and Penttinen et al. (2011). The second multiplier, capital turnover, stands for asset turnover velocity, and the third for the financial leverage. The ROE can thus be improved by increasing profitability, using assets more efficiently and increasing financial leverage. Increasing the efficiency of the asset usage, turnover/assets, will always improve the ROE. However, ROE increases with financial leverage only as long as the returns earned on the borrowed funds exceed the cost of the borrowings. Moreover, the danger inherent in increasing borrowing beyond a certain level is that the increased financial risk may cause the value of the enterprise to fall or even collapse, especially in bad times. In all, increasing the debt burden increases ROE in theory only as long as the additional business yields more than the additional debt costs.

2.3 Investment, spread, weighted average cost of capital (WACC) and economic value added (EVA)

The initial concept of ROE can alternatively be defined by applying the concept of 'spread' = operating ROA – effective interest rate after tax. Then ROA = operating ROA – (spread * net financial leverage), where operating ROA = net operating profit after taxes / net assets and net financial leverage = net debt / equity (Palepu et al. 2007). The 'spread', which is a key concept, measures whether the business of an enterprise yields a better return than the cost of debt.

Investments decrease the return on assets (ROA) because of increased depreciation and increased total assets. Thus ROA will increase only if these assets make a sufficient contribution to revenue (Dehning and Stratopoulos 2002). The impact of investment is also a key research question in wood procurement SMEs. The fundamental premise underlying value-based management (VBM) is that shareholder value is created when return on capital exceeds the cost of capital; e.g., the weighted average cost of capital (WACC) and the financial goal of an enterprise is economic value added (EVA) (Slater and Olson 1996) rather than net profit.

2.4 Correlation

Kuh and Meyer (1955) have already shown that a spurious correlation exists for ratios with a common denominator which equals the partial correlation between numerator series with the influence of the deflating variable held constant. The inter-temporal correlation of financial ratios also requires careful a priori determination of their proper usage in any prediction analyses (Horrigan 1965). Empirical

findings suggest that size is strongly correlated with both the first and second moments of the commonly-used ratios, which is true even when size is defined as sales, total assets, or market value (Hopwood 2003). Quick ratio, for example, was found to have a very low correlation with failure function but, surprisingly, a high correlation with relative success (Houghton and Woodliff 1987).

2.5 Factors and ratios

Applying factor analysis to financial ratios in a service sector has produced (i) net worth position, (ii) profitability index, (iii) fixed asset management, (iv) leverage position, and (v) working capital management (Ali and Charbaji 1994). An analysis based on Hong Kong companies suggests the following ratios: ROI, gearing (debt to assets), working capital management, fixed asset management, long-term solvency, short-term solvency (Laurent 1979). Pinches et al. (1973) found seven empirical categories: ROI, capital intensiveness, inventory intensiveness, financial leverage, receivables intensiveness, short-term liquidity and cash position. The empirical evidence seems to suggest that factor analysis cannot distinguish a separate profit-margin grouping, although traditional financial theory suggests three measures broadly defined as turnover ratios, profit margin ratios and earning power (rate of return on investments). The evidence has pointed to three issues: return on invested capital, overall liquidity, and short-term capital turnover such as inventory and receivable turnover (Pinches et al. 1975). Performance measures might include (i) net margin on sales (percent), (ii) net profit per employee, and (iii) turnover per employee (McMahon and Davies 1994). Square root transformed ratios, four factors were found with the best loadings to ROE: current ratio, cash flow to sales and working capital to sales (Martikainen et al. 1995). In the case of failing companies, the key elements are declining profits, increasing borrowing, declining working capital and falling sales (cf. Robertson 1983). Johnson (1979) used factor analysis and found ratio groups for ROI, financial leverage, capital intensiveness, inventory intensiveness, cash position, receivables intensiveness, short-term liquidity and decomposition measures in which the compositions and importance of each ratio remained remarkably stable. By contrast, it may be unrealistic to assume that ratio groupings, whatever they may be, will remain consistent and stable over time (Cowen and Hoffer 1982).

Opportunities to affect various contributions and success measures can be combined into their logistic contribution (figure 2).

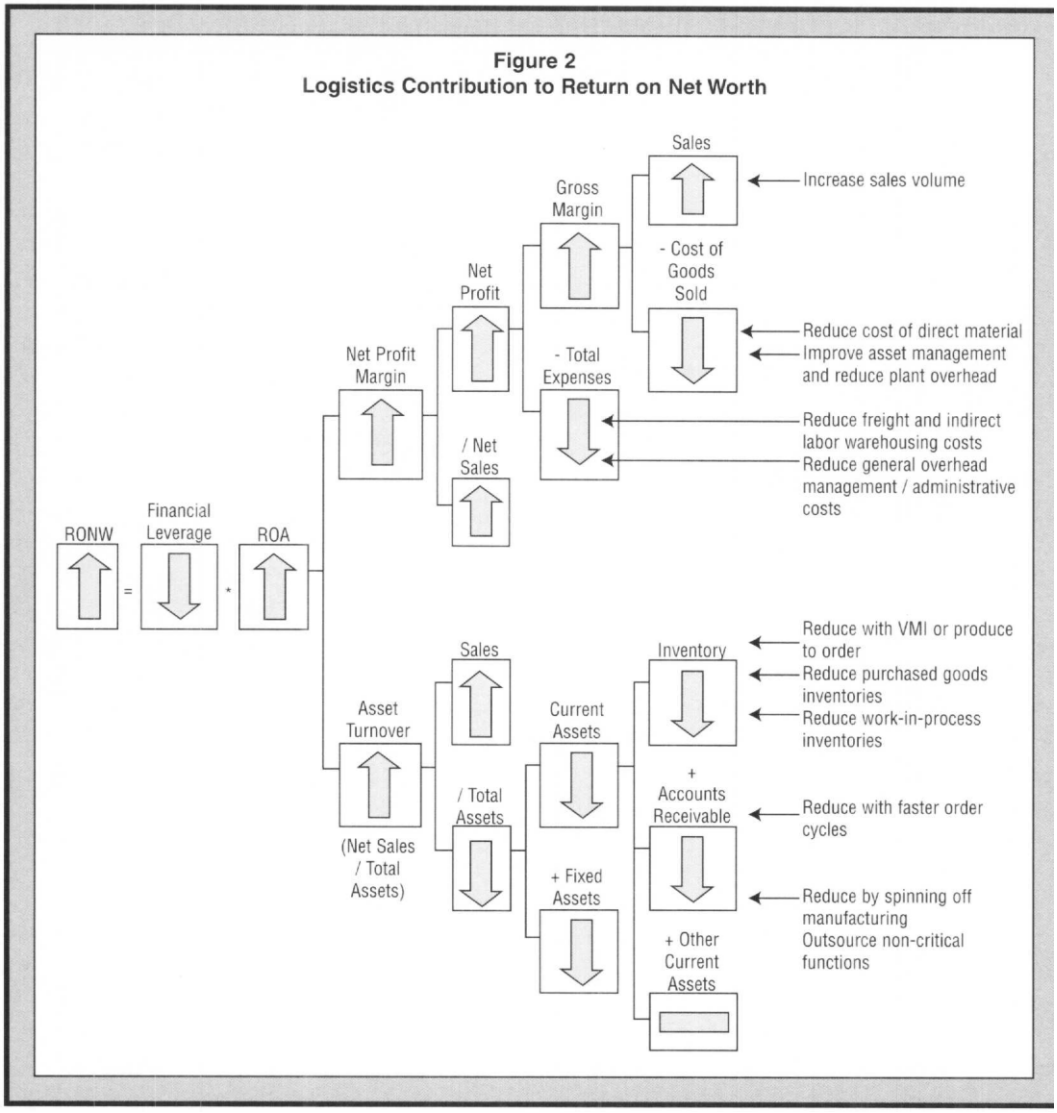

Figure 2. Impact opportunities in the logistic contribution (Stapleton et al. 2002)

Empirical evidence from contractors in economic turmoil suggests that the following circumstances may indicate that the company has problems in continuing its business (Chan et al. 2005):

(i) Net liability or net current liability.

(ii) Excessive reliance on short-term borrowing to finance long-term assets.

(iii) Negative operating cash flows.

(iv) Adverse key financial ratios.

(v) Substantial operating losses or significant deterioration in the value of assets used to generate cash flow.

(vi) Arrears or discontinuance of dividend payments.

2.6 Economies of scale and the debt level

Empirical evidence from Portuguese SMEs suggests that greater size allows greater benefit from scale economics, but imposes a negative relationship between the level of debt and the performance as well as a negative relationship between the level of tangible assets and the performance (Serrasqueiro and Nunes 2008). Enterprise size was positively related to debt level, SMEs with more growth options apparently employing more debt, and the financing of SMEs relies more on internal sources than external means according to Spanish data panel (Sogorb-Mira 2005), the last statement of which corresponds to the Pecking Order Theory (POT) (Myers and Majluf 1984). Surprisingly, profit and age are negatively related to debt, but size is positively related to long-term debt according to Hall et al. (2004).

Key hypotheses for testing the POT of capital structure were the relations between profit, growth, asset structure and size related to long-term and short-term debts, and hypotheses such as profit and age being negatively related to debt, but size being negatively related to short-term debt appears to hold up reasonably well (Hall et al. 2004). Testing the POT and the trade-off theory (TOT) of capital structure suggests that high growth firms have a lower debt ratio, more profitable firms have less debt and, in contrast to most studies, larger firms tend to have a higher debt ratio and a shorter debt maturity (Heyman et al. 2008). The capital structure of small firms is time and industry dependent. Short-term debt tends to increase during economic recessions and decrease as the economic conditions improve. On the other hand, average long-term debt ratios exhibit a positive relationship with changes in economic growth (Michaelas et al. 1999).

3. PURPOSE OF THE STUDY AND HYPOTHESES

The purpose of this study is to analyse the success and failure factors of timber-harvesting enterprises from the financing point of view. Scientific disciplines are applied, especially those of accounting and statistics for practical purposes to support the decision-making of these enterprises.

Horrigan (1965) claimed that 'only a small number of financial ratios are needed to capture most of the information ratios can provide'. Thus a key finding of this study is a financing ratio recommendation for the small and medium sized enterprises (SMEs) of this sector.

Recall that a firm's performance, return on sales, has been decomposed into productivity, price recovery, product mix and capacity utilisation, in which price recovery, for example, has been further decomposed into measures of changes in input and output prices by Banker et al. (1993). This profit decomposition could also be an ultimate goal of these wood procurement SME studies, but the Statistics Finland material (2009) of this study does not contain productivity and product mix data.

4. DATA

4.1 Key features of the wood-harvesting business

There is no single description of a forest-machine enterprise. The Finnish Vehicle Administration (TraFi 2010) maintains a register of over 5600 forest machines, which also includes some old and even scrapped machines because there are no annual payments or an obligatory updating process. Excluding old and inadequate machines leaves about 4000 machines and 1600 owners (Penttinen et al. 2009b). A monthly inquiry on the forest industry, forest management associations and State Forests [officially Metsähallitus] indicated that some 4600 machines were working in January 2008 (Metinfo Forest Statistics 2011). Forest harvesting is frequently a supplementary business in agriculture. In 2005, 1300 farms had income from forest harvesting (Tike 2010). Many of these farm owners operate with farm tractor-based machinery and only on a part-time basis (Penttinen et al. 2009b). The bulk of the harvesting work is done by full-time enterprises using special machinery. However, the considerable annual seasonal variation in working volumes requires a multi-business approach in order to cope with those periods of the year when harvesting activities are at a minimum. In Finland, three international forest industry companies buy two-thirds of the roundwood harvesting services and more than half of the energy-wood harvesting services (Finnish Statistical … 2010).

Forest-harvesting contractors have already been responsible for industrial roundwood harvesting in Finland for over forty years (cf. Högnäs 2000 and Uusitalo & Markkola 2006). Energy-wood harvesting, for example, is an increasingly significant task and its volumes are growing. The production of heat for local communities using bio-fuelled power plants also employs some contractor entrepreneurs (Solmio & Alanen 2008). Some of the forest regeneration tasks (soil preparation, seeding and increasingly planting) are also carried out by wood-harvesting contractors (Finnish Statistical … 2010).

The number of enterprises in the harvesting business is still dominated by very small entrepreneurs. Half the enterprises have only one or two machines per company, but their total turnover is only one-third of the sector's total turnover (Penttinen et al. 2009a). The largest companies own about 30 machines and employ some 50 operators. Customer structure is almost the reverse. The three largest forest industry companies and State Forests buy more than 80% of the total forest machine enterprise services, which leads to a situation in which enterprises have little negotiation power (Alajoutsijärvi et al. 2001). Customer-bound wood scal-

ing and data transfer systems assign enterprises or at least their machines to one customer only. The economic recession, with the closure of forest industry mills, has led to markedly lower harvesting volumes (Metinfo Forest Statistics 2011), which has intensified the competition between harvesting enterprises. Moreover, the forest industry customers prefer negotiating with fewer forest contractors who might have subcontractors (Rekilä and Räsänen 2008). The impact of fewer so-called area entrepreneurs on the cost-effectiveness of timber harvesting has been researched by Matilainen (2007) without a clear solution so far.

The traditional 'capacity service business model' for industry services was based on exact harvesting orders and other tasks, which were performed one at a time. However, a more effective 'partnership-based business model' (Hannus 2004: 311) means that more comprehensive services are provided, often in enterprise networks with subcontractors (Yang & Mohammed 2008). Lately, even the interest in collaborative transportation planning to support the coordination of the wood fibre flow has risen, since important potential savings have been identified (Audy et at. 2007).

The mechanisation of wood-harvesting procurement triggered an excellent productivity trend in Finland, which however culminated at the beginning of 2000 (figure 3). The higher productivity of new machines also seems to be overshadowed by poorer working conditions.

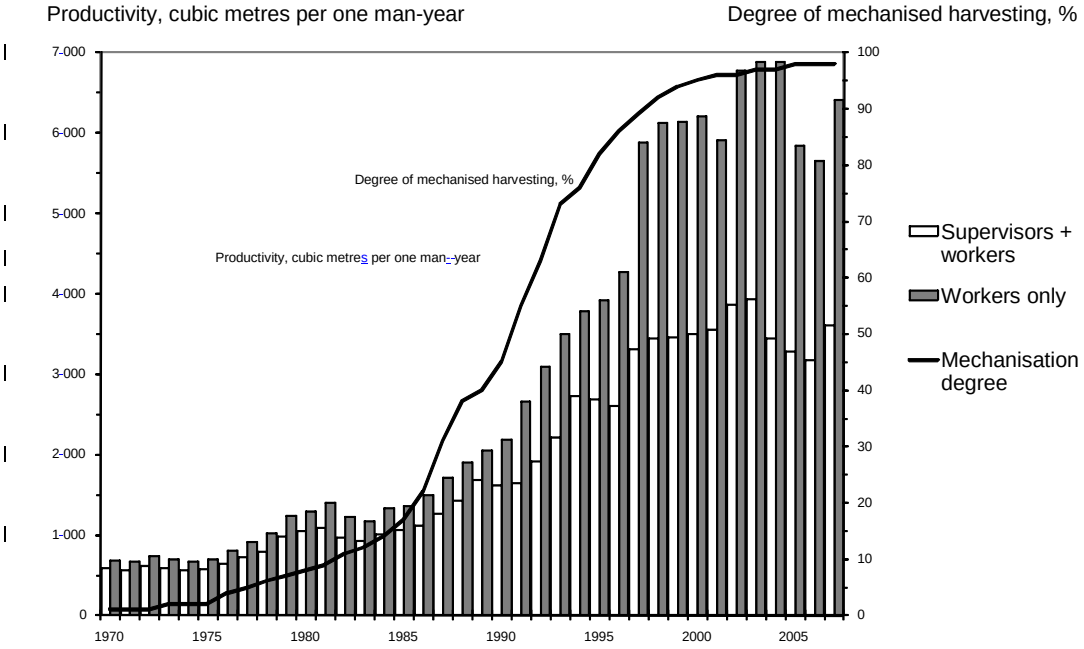

Figure 3. Development of productivity of harvesting work calculated by cubic metres harvested divided by number of workers from 1970 to 2007. Harvesting consists of felling, delimbing, cross-cutting and transport from stump to road-side. Data source: Finnish Statistical … 2010.

Forest machine business costs and their trends are monitored by Statistics Finland (Metsäalan konekustannusindeksi ... 2010). The cost structure follows the requirements of this business. Wages with incidental costs take up the largest proportion; fuel and service costs compete with the depreciation cost for the second highest (figure 4). About one-third of wage costs are the travel and lodging costs of operators. The wage cost has risen clearly in the last year. Wage cost was larger for forwarder depreciation but smaller for harvesters. Interest, fuel and lubricant costs increased rapidly till 2008, but then dropped to the lowest level for the whole period. Other constant costs include administration, supervision and insurance, which also have risen steadily through the whole study period. During the last five-year period, the proportions of costs have changed only slightly. Total costs were 10 percent higher in 2009 than in 2005. During this period, the costs were highest in 2008, 20 percent over that of 2005 (figure 4).

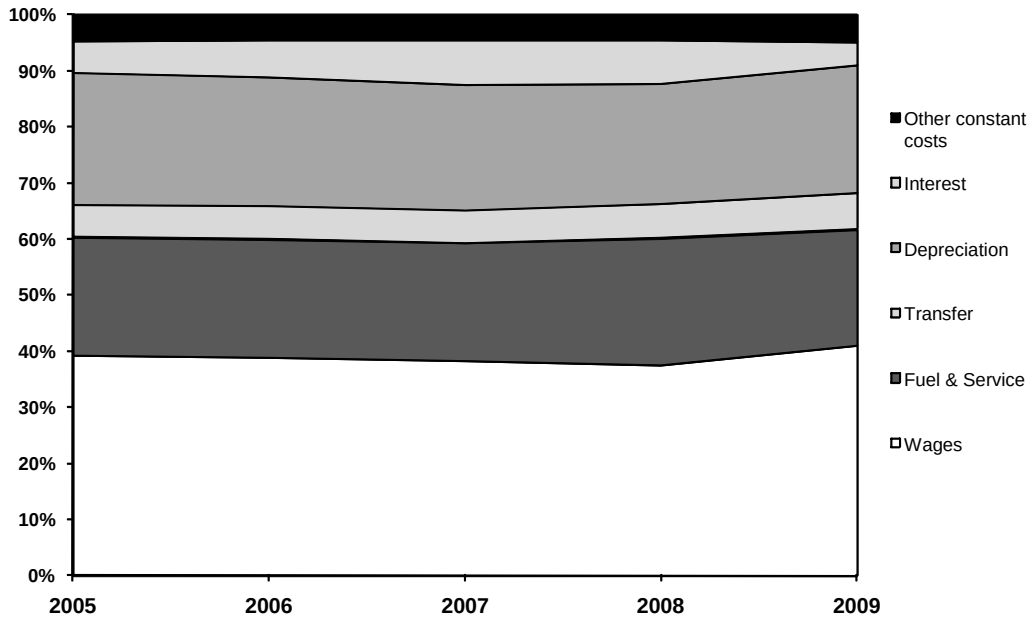

Figure 4. Forest machine business cost structure from 2005 to 2009 according to Statistics Finland forest machine cost index (Metsäalan konekustannusindeksi ... 2010).

The profitability expectations of the customers of forest-harvesting enterprises, i.e., mostly multinational forest industry enterprises, are high. For example, StoraEnso's target is to achieve 13% ROCE (return on capital employed) (StoraEnso 2007). Unfortunately, the actual profitability and especially its trend has been poor (figure 5).

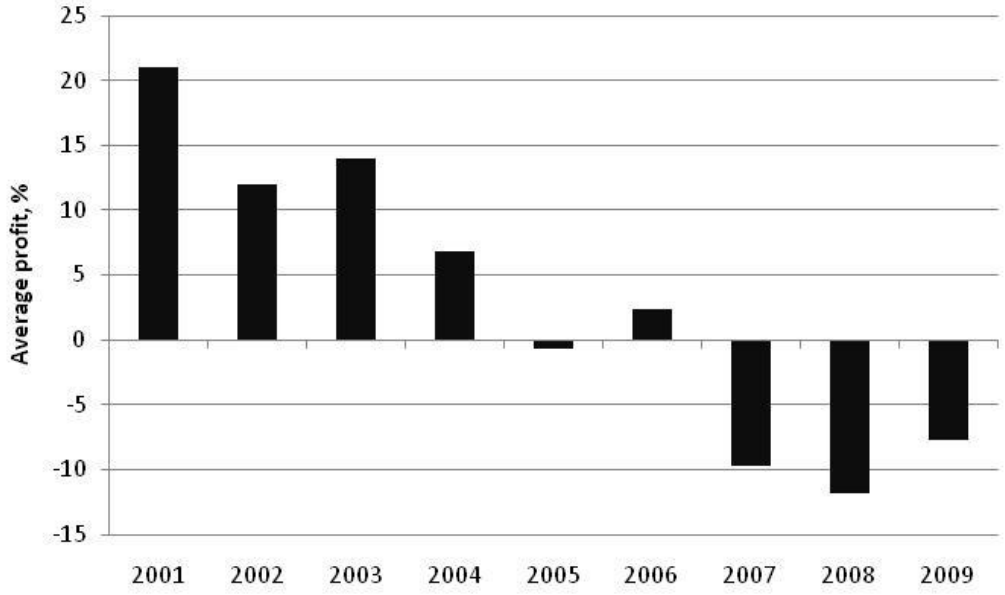

Figure 5. Profit before tax for Finnish forest companies in from 2000 to 2008 (Finnish Statistical Yearbook of Forestry 2010)

The profitability of forestry is a key research area. Even energy-wood thinning based on effective timber harvesting is often profitable for the forest owner (Heikkilä & Sirén 2006).

4.2 Accounting material

The following economic analysis utilises material concerning about 1600 enterprises derived from the Vehicle Administration data (Statistics Finland 2009). Because of missing data, each key figure has a different number of observations, generally about 1000 enterprises (fig. 6). According to the fiscal regulations, limited companies have to produce accounting data for the tax authorities and therewith for Statistics Finland. General and limited partnerships and one-man businesses are not obliged to deliver such extensive data, which can be seen (fig. 6) as the lower number of enterprises which have produced the closing of the

books originally supplied to tax authorities but used here for the ratio analysis. All the limited companies and those enterprises with other company forms that have provided enough financial statement information for the analysis appear among the ratio analysis enterprises.

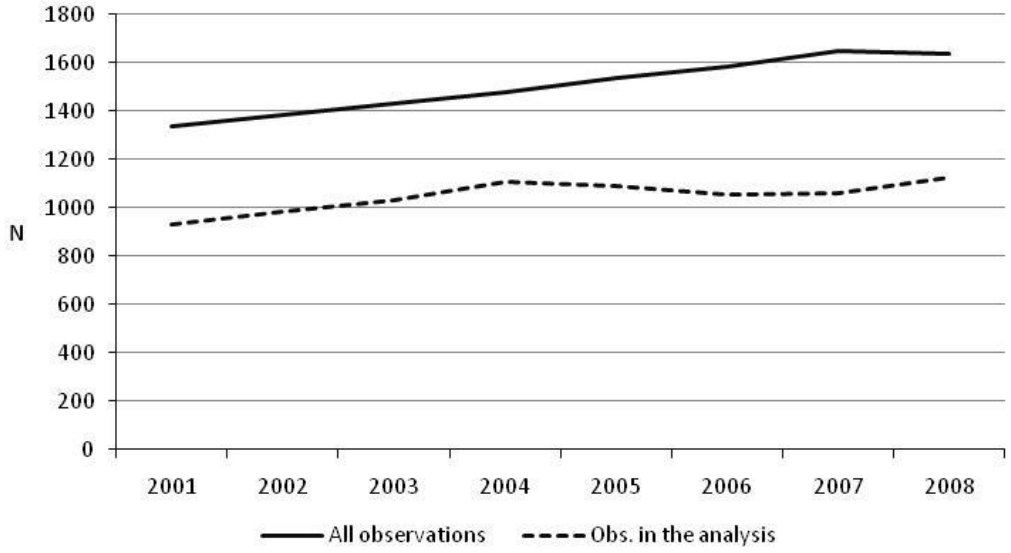

Figure 5. Number of wood-harvesting enterprises 2001-2008 in Statistics Finland (2009) data. Beside the total number of enterprises, the number of enterprises which have produced the closing of the books data used for ratio analysis also appears.

A harvesting enterprise usually starts as a one-man one-machine firm and the growth of the business brings along a more organised form of firm. This can be seen (figure 7) in that the average turnover of all Statistics Finland data enterprises is about 70 per cent of the turnover of firms which have produced ratio analysis data. All following results, which are based on ratio analysis, thus represent slightly larger enterprises than the total average. Note that many enterprises also conduct other businesses than timber harvesting.

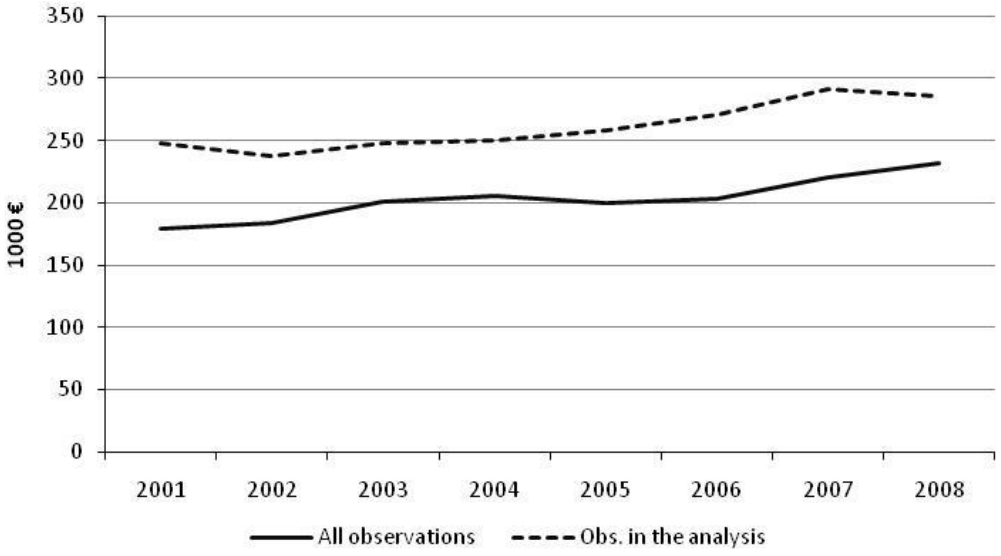

Figure 7. Average turnover of harvesting enterprises 2001-2008 in Statistics Finland data (2009). Average turnover of ratio analysis enterprises stands for those enterprises which have produced the closing of the books data used for ratio analysis.

5. FINANCIAL ANALYSIS RESULTS

5.1 Profitability of wood-harvesting business

The median profitability of forest-machine enterprises remained negative from the 1980s until the recession in the 1990s (Mäkinen 1988, 1993) and achieved roughly an 8% level in 1995-2000 (Väkevä & Imponen 2001). The banking group Pohjola annually monitors the economic situation of its wood-harvesting contractor customers, which has shown moderate or poor results (Turkulainen 2008, Saviaho 2009). The profitability of the wood-harvesting business is poor in Sweden as well (Pekka 2008). The degree of mechanisation and the customer structure varies in other European countries, but profitability problems prevail everywhere (Rummukainen et al. 2006). The net profit percentage of the wood-harvesting business was low compared to many other industries in Finland, except for wood products industries (2% net profit)(Ministry of ... 2009).

During the period of this study, the net result has decreased slightly (figures 8 and 9). The benefits of mechanisation and thus productivity have not been contributing any more over last ten years (figure 3). The financial situation of customers, i.e., the forest industries, has also been poor over the same period (figure 5 and Wood products industry 2010). All the following figures represent ratio analysis of enterprises based on Statistics Finland (2009) data.

The net result percentage is a key ratio in focusing on profitability (Kallunki & Kytönen 2007). In 2001-2008, the median of the net result grew up to 2003 and since then has been decreasing (fig. 8). The smallest enterprises have clearly lower results than larger ones. The largest companies had the next lowest net results at the beginning of the period, but approach other size enterprises later. Medium size companies usually have the best net results, but the margins are small and vary between years. Results have been falling for the last five years. At the beginning of that period, there was a strong cost increase in oil products (Penttinen et al. 2009a). In 2005, there was a paper-workers strike for four weeks, which also cut harvesting work. However, 2007 was a record year in Finland, more wood being harvested than ever, as can be seen as slightly better results in 2007 in most enterprise size classes. Thereafter, harvesting volumes were lower and even short stoppage of harvesting work was required by customers. In 2008, results were decreasing again except for the smallest enterprises.

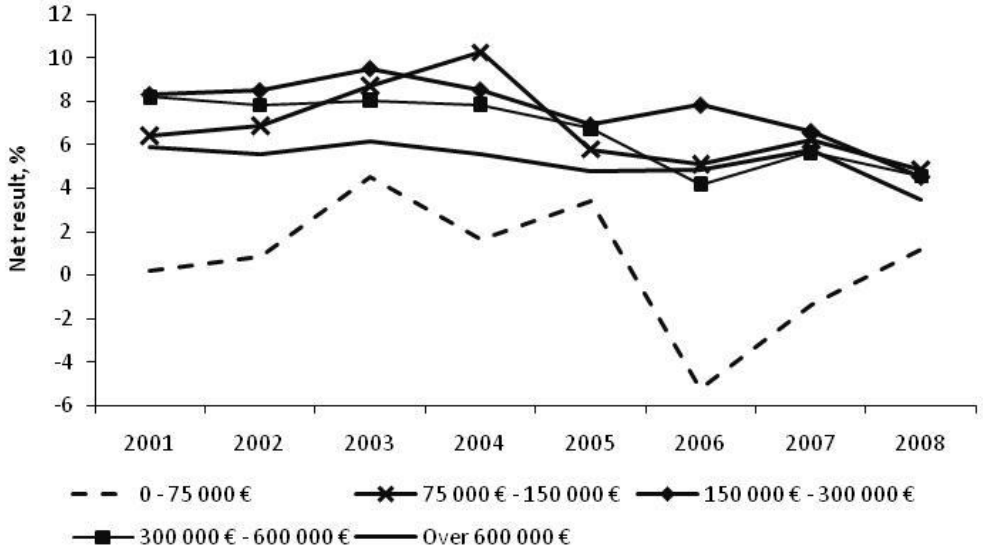

Figure 8. The medians of the net result in percentages by enterprise turnover class from 2001 to 2008 for some 1050 enterprises. Entrepreneurs' own salary reduction according to the Statistics Finland rules.

The median net results of limited companies have been pretty steady through the years (figure 9). Since there is a slight increase in 2007, they may have benefited from the large harvesting volume in that year. One-person enterprises show the largest variation in net result through the years. They also show a clear increase in net result in 2007. Partnership enterprises have had the best net result median through the whole period, but the high volume year 2007 can be seen as a decrease in their result, in contrast with other company types. The median net result of the limited partnerships and the one-person enterprises has varied between the results for partnerships and the limited companies. Since 2003, the general trend in net results has been decreasing.

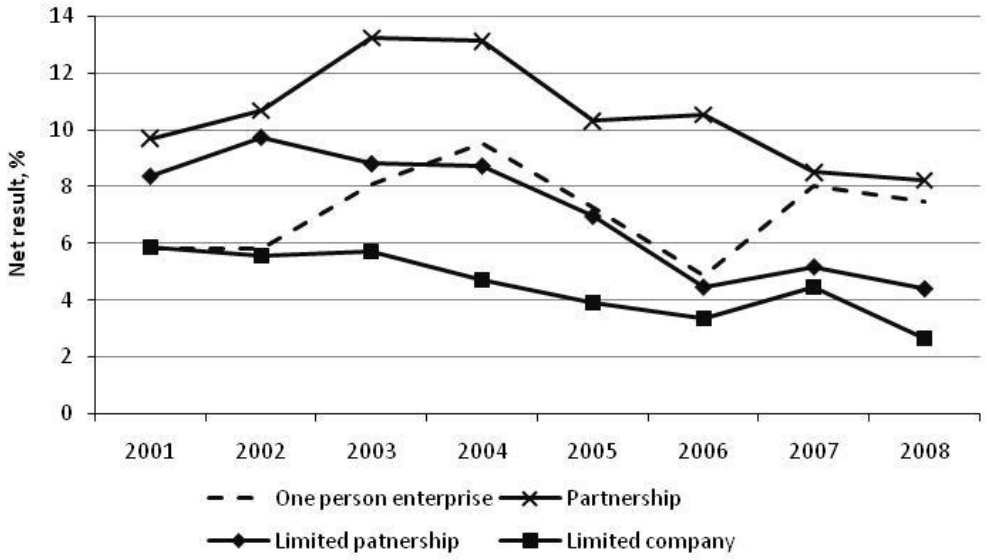

Figure 9. The medians of the net result in percentages by enterprise form class 2001-2008 of some 1050 enterprises (fig. 6). Entrepreneur's own salary reduction according to the Statistics Finland rules.

Net results for 2008 show a large variation in smaller enterprise classes (fig. 10). The two smallest classes have the highest upper quartile results, but also the lowest lower quartile results. The median result is only slightly positive. The result varies much less in larger enterprise classes.,the lower quartiles being almost positive, but the best results are also much smaller than in smaller enterprise classes. Large company size requires that the operations be planned on steady positive results, but the competition and powerful customers may keep results low. The surprising variation in the net result of the smallest enterprise group opens the question of whether there are differences in the skills, diligence and initial wealth of the entrepreneurs

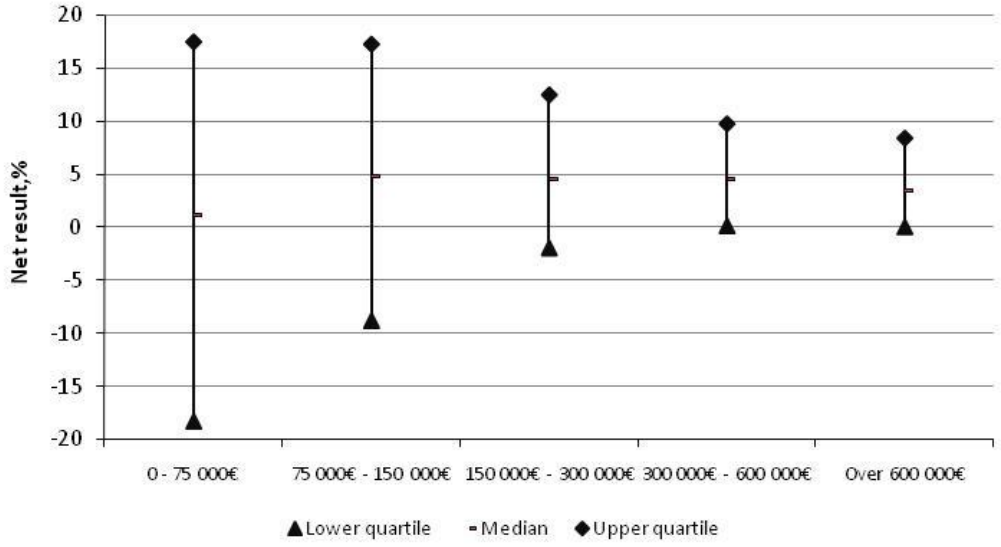

Figure 10. The lower quartile, median and upper quartile of net result (in percentages) of harvesting enterprises in turnover classes in 2008. The entrepreneur's own salary reduction according to the Statistics Finland rules.

In Finland, while owners of individual and partnership enterprises cannot pay a salary to themselves, owners of a limited company can do so. This leads to a situation in which we cannot directly compare the net results of a limited company and other enterprise forms. If the owner of a limited company takes a salary, the remaining net result is real profit. In individual and partnership enterprises, most of the owners have to take their living from the net result given in these figures. There is a small wage reduction in figures 8 and 9, derived by Statistics Finland from tax data. For many reasons, owners of individual and partnership enterprises try to avoid showing their personal costs for taxation purposes.

This explains why we have reduced the net result of individual and partnership enterprises with a modest salary correction. The value of a more realistic salary correction here is one operator's typical salary (in one-person and limited partnership enterprises) or one and half (in general partnership enterprises) without any social costs. The value of this was 20,000 € for one-person and limited partnership enterprises and 30,000 € for general partnership enterprises. This reduction changes net result figures dramatically (figure 11). In the smallest enterprise class, even the net result of upper quartile enterprises is negative. In the next size class, the median is still negative. In the two largest enterprise classes, the positive net result follows the net result figures without a larger salary reduction. Most of the enterprises in these groups are limited companies, where there is no salary reduction, because owners can pay themselves a salary (figure 11).

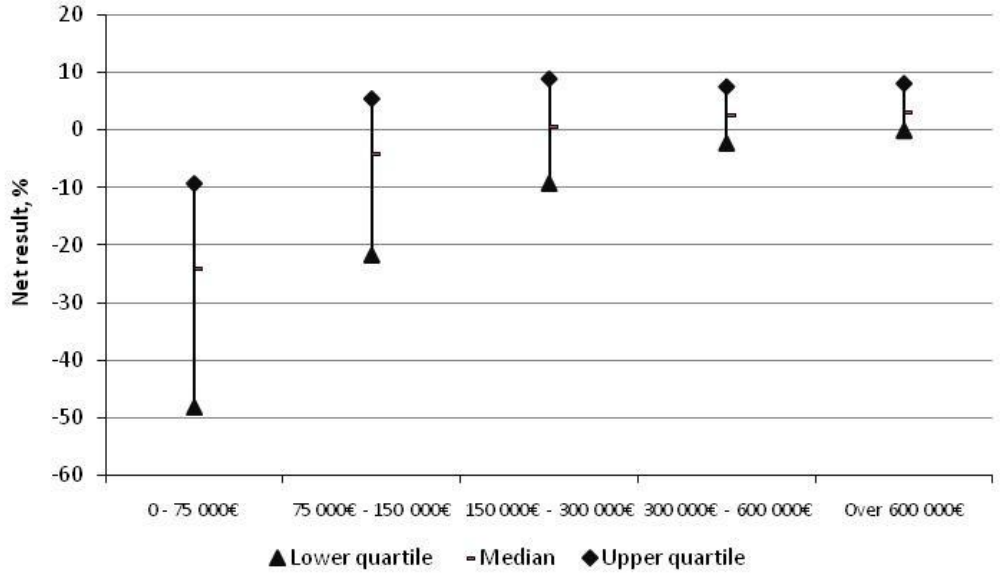

Figure 11. The lower quartile, median and upper quartile of net result (in percentages) of some 1050 harvesting enterprises in turnover classes in 2008. Salary reduction of 20,000€ or 30,000€ has been applied to one-person and partnership enterprises (see text in previous paraprahp).

Some of the owners of the smallest turnover class enterprises may have other incomes than their harvesting enterprise as well. Most enterprises in the two smallest turnover classes produce negative results, even when the enterprise is the sole supporter of the owner, raising Tte question of how long these enterprises can continue in business.

Capital costs represent nearly a quarter of the total costs in wood-harvesting businesses (figures 4 and 12). Figure 4 showed the cost index based on the trends in particular cost factors. Figure 12 show a hardly changed cost division, because it is based on the taxation rules. For example, the profit is entirely missing in figure 4. There are also some other differences between figures 4 and 12.

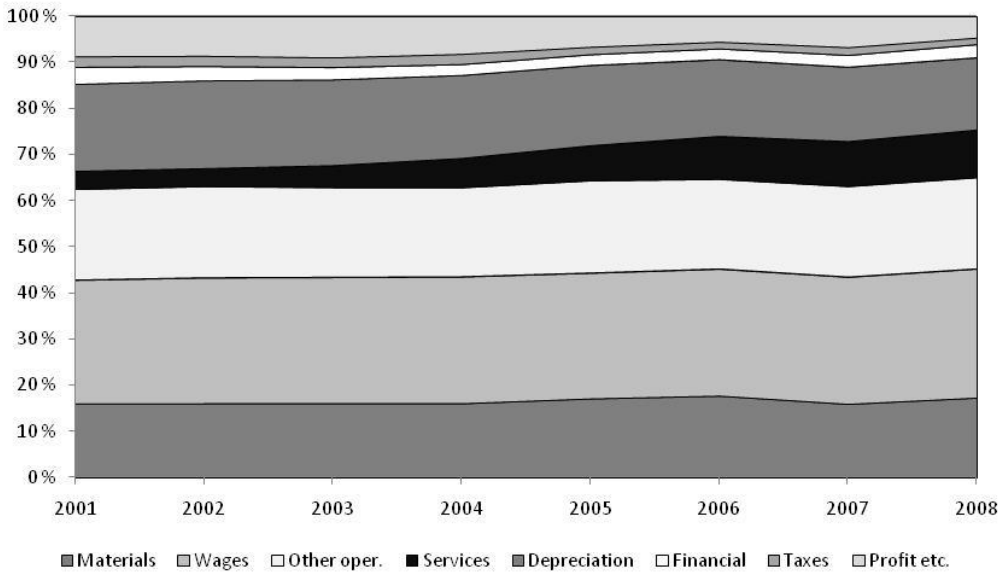

Figure 12. Cost structure of forest machine business 2001 – 2008 according to Statistics Finland accounting data (2009).

Here the wages constitute the biggest category of cost, the proportion having remained quite stable. The services sector has increased, while the proportion taken by the profits has decreased.

5.2 Financial adequacy

The tangible assets of wood-harvesting enterprises are primarily forest machines. A special feature of this sector is that the capital is tied up in machines and equipment, debt being incurred to purchase them. The situation of enterprises and their financial structure can be illustrated by subtracting debts *from the value of tangible assets*, dividing the difference by the tangible assets. This ratio indicates the extent to which the enterprise activities are based on their own financing. Surprisingly, even its median crawls along the zero level all through 2001-2008, which can partly be explained by the maximum depreciation. However, even median enterprises tend to have more debts than the book value of their machines so that they cannot finance machines with their own funding. This limits their opportunities to choose ways to operate.

Successful financing and effective use of invested resources impacts the profitability, liquidity and solvency of an enterprise. Points of views in finance analysis are *financial adequacy* and *capital structure*. In small and medium sized enterprises (SMEs), financial adequacy is essential or critical even in normal times. Capital structure provides only a general picture. In other words, the dynamics of economic processes – the flows – are critical to daily operations where static fac-

tors – the reserves – are primarily only background information. Recall that the classical contribution of Modigliani and Miller (1958) had already emphasised the profitable use of resources rather than the capital structure.

5.2.1 Debt burden

The *liquidity* ratios could be grouped into (i) dynamic liquidity, such as financing result percentage, (ii) static liquidity, such as quick ratio, (iii) other ratios, such as combined ratios, e.g., net working capital percentage. *Solvency* consists of (i) static solvency, such as equity ratio and (ii) dynamic solvency, such as loan repayment margin or liability pay-back period (Laitinen and Laitinen 2004). Here, empirical financial results for the wood harvesting branch are grouped into: (1) debt burden, (2) investments and reserves, (3) liquidity and survival times and, (4) capital structure. This grouping corresponds to the concepts and everyday financial challenges of the entrepreneurs.

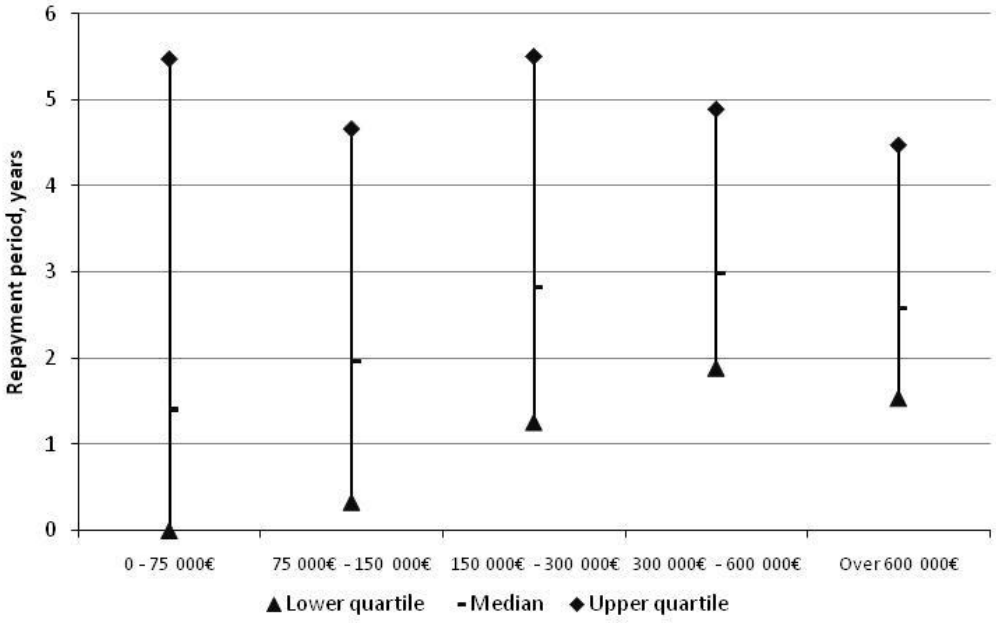

Figure 13. The median and lower and upper quartiles of repayment period by turnover class in 2008.

The typical holding period of a new forest machine is 3-5 years, which is comfortably in line with these payback periods. There are various approaches to how enterprises utilize machines. Some buy new machines and use them effectively, typically in two shifts and sell after three to four years. Smaller enterprises usu-

ally buy these second-hand machines and also use them for three or four years or to the end. Some smaller enterprises buy new machines and use them until their mechanical end. Manufacturers promise 10-20,000 hours life-span for a harvester and forwarder base machine. When machines are utilised 2-3000 hours per year, their useful life is 5-10 years. There are differences in enterprise's investment and thus payback policies. For a one-machine enterprise, the decision on when to buy a new machine is very important for the budget of the whole enterprise. Since large companies with several machines change some machines every year, there is not much variation in investment between years.

The enterprise using the whole *operating profit for debt payment* describes the theoretically rock bottom payback period. The medians of this theoretical pay-back period loosely follow the values of the repayment period (fig. 13). A good level is presented by a value below two, satisfactory 2-5 and weak over that (CCA 2005). The medians of the two smallest enterprise groups are lower than two and the medians of the remaining groups below three. These values are not that bad, but the variation between the groups is large and almost a quarter of all the companies have values above than five, which is considered weak (The upper quartile is 4.8).

An alternative way to estimate the opportunities to manage financial expenses is the *interest expenses coverage ratio*, which can be obtained by dividing the sum of operating margin, dividend return, interest return and other financial return by financing expenses. This ratio measures the sufficiency of the operating margin and financing returns for covering the financing expenses. Both the ratio and its variation were lowest in the smallest turnover group and highest in the largest turnover group (fig 14). The median interest rate coverage for the complete data was 8.5, and values above 8 can be considered good, 3-8 satisfactory and below 3 weak (CCA 2005). Over half the enterprises were classified as good or better. In 2001, the interest rate coverage was at same level as 2008, while the ratio was at its highest in 2004. The drop between 2007 and 2008 was the sharpest during the period. Differences between turnover classes remained almost same during the whole period.

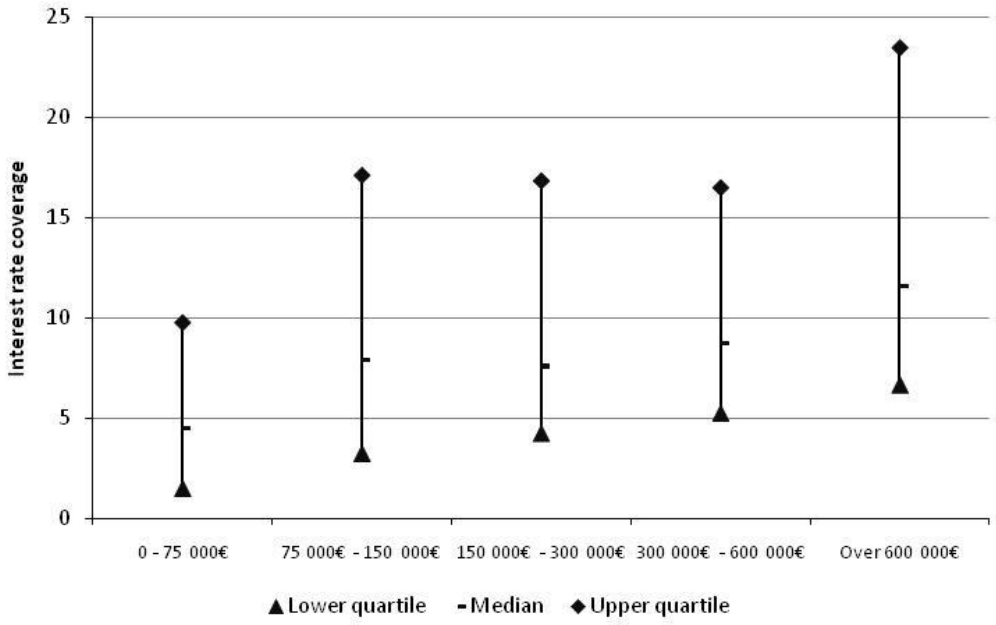

Figure 14. The lower quartile, median and upper quartile of the interest expense coverage ratio in 2008.

The financial expenses can also be evaluated in relation to operating margin, which it seems can cover the net financing expenses quite well (figure 15). The ratio has approached 8% in the group of the biggest enterprises. In the period from 2001 to 2008, the medians first decreased until 2004 and have since approached the same levels as 2002. This ratio helps to evaluate the required operating margin level related to the financing cost structure. The net financing expenses can also be evaluated in proportion to the turnover (CCA 2005). The financial expenses limit the development and profitability of an enterprise and might in the worst case even limit the use of depreciation (figure 15).

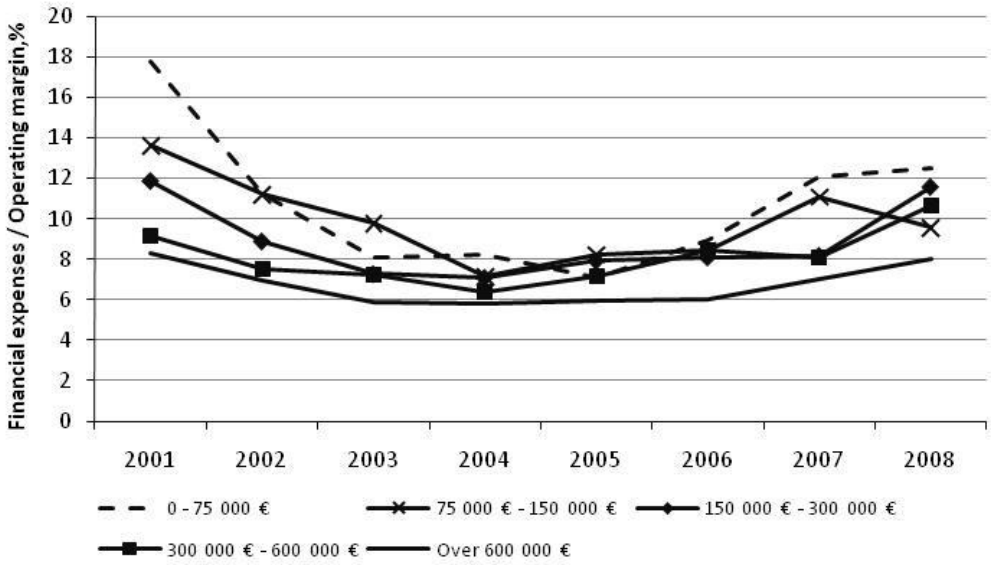

Figure 15. Financing expense medians related to operating margin by turnover class 2001-2008.

The medians tend to decrease with the enterprise size. Moreover, the upper quartiles tend to decrease and lower quartiles increase when the enterprise size increases. The differences between enterprise classes are small but follow the same pattern throughout the years, the smallest ones having highest and the biggest ones the lowest relative financial expense burden. Interestingly, the relatively low interest rates have not led to an increase in the debt burden in 2006-2008.

The average financial expenses, simply the average interest rate on loans, stand for financial external financing expenses divided by debt. The median enterprise-paid for loans was roughly 4.4% in 2008, the lower quartile was 3.1% and the upper one 5.6%, depending surprisingly clearly on the enterprise size. Both the level and variation clearly decrease with company size (figure 16).

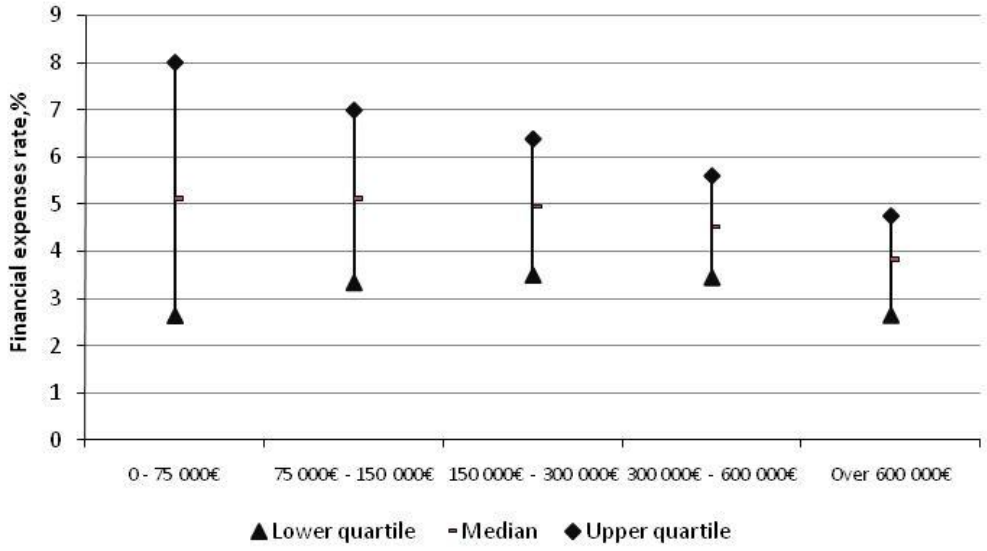

Figure 16. Lower quartile, median and upper quartile of financial expense rate by turnover class 2008.

The period from 2001 to 2008 reveals the movement in the general interest level, which was first down in 2001-2005 and then up again after 2005 (figure 17). Moreover, one can expect that these expenses will keep rising as the interest rates have been quite low in recent years compared with the 8 or 9% median level in the 1990s (Mäkinen 1993).

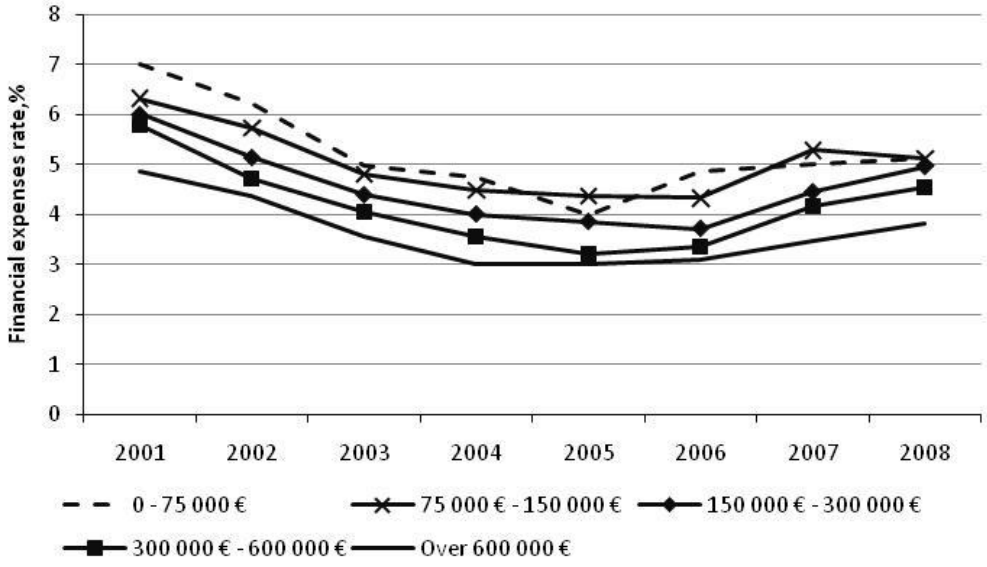

Figure 17. Medians of financial expense rate by turnover class 2001 – 2008

The interest expense coverage ratio and interest rate (average financial expenses) are relevant to follow at the aggregate level. However, the payback period and financial expenses related to the operating margin are also important when studying an individual enterprise.

5.2.2 Investments and reserves

Gross investments form a base to depict the financial opportunities. Their annual median (36,000 €) was only roughly 12% of the value of a forwarder (price about 300,000 €) in 2008 (fig. 18). The lower quartiles of the three smallest company groups were practically at the zero level and the median of the smallest groups was only 1,600 €. These firms hardly invested anything. In the biggest enterprise class, the median exceeded 100,000 €, which approaches one-third of the value of a forest machine. These levels are a bit higher than the 1995-2000 results, in which the median was 33,000 €, lower quartile 0 € (here 2,800 €), and upper quartile 100,000 € (here 151,000 €) (Väkevä & Imponen 2001).

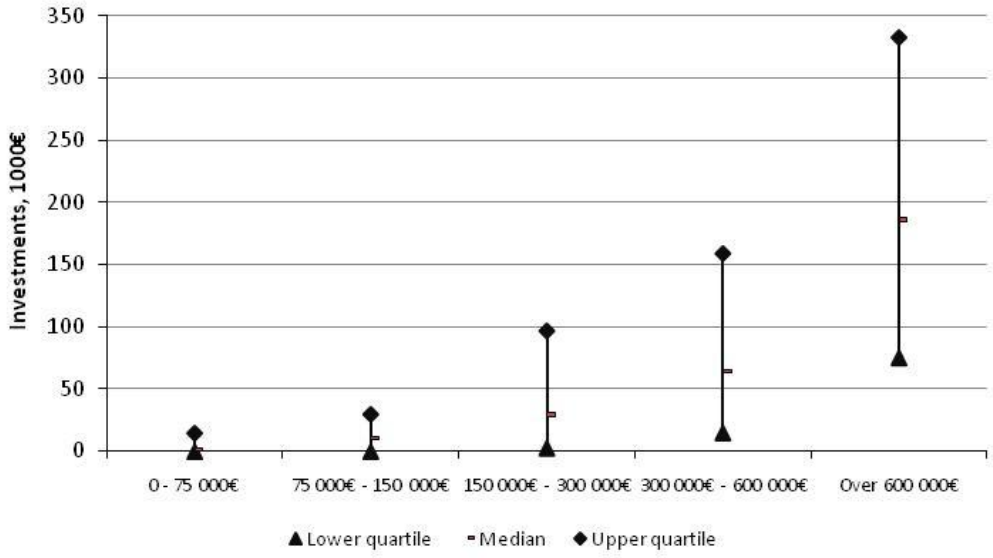

Figure 18. The lower quartile, median and upper quartile of gross investment by turnover class in 2008

The investments vary greatly by enterprise class, but are surprisingly stable in each enterprise size class over the years. However, the differences between enterprise size groups are so clear during the whole period that it prompts the question of whether the smallest ones invest and develop their business at all.

In order to eliminate the effect of the enterprise size, the gross investments can be calculated in proportion to the turnover, which results in a median of 13.6% . The lower quartile again remains near the zero level for the three smallest turnover groups and the upper quartile for the complete data is 32.4%. These figures are somewhat smaller than those reported by Väkevä and Imponen (2001) in which the lower quartile, median and upper quartile were 0%, 18% and 45%. The investment in proportion to turnover also varies heavily by turnover class (figure 19).

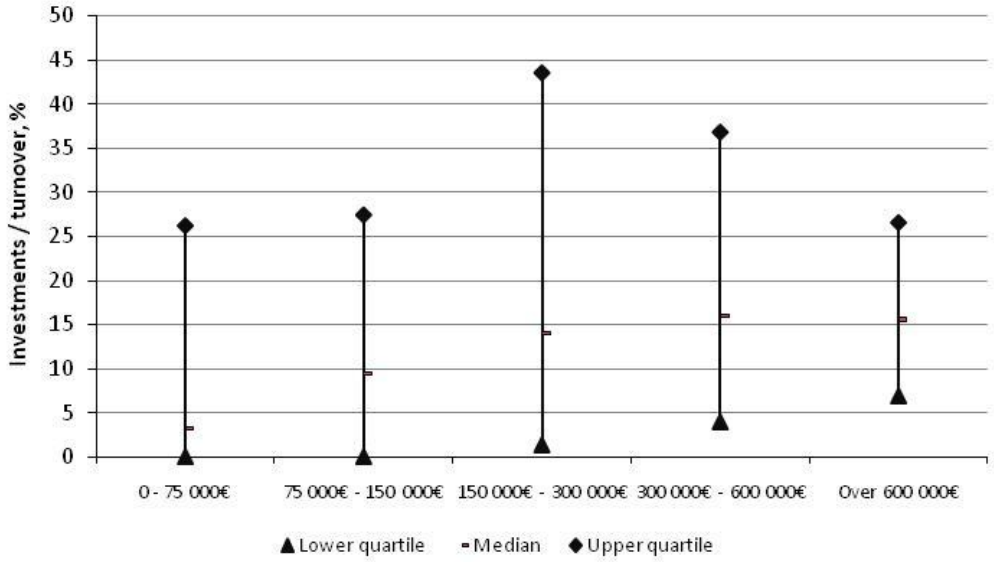

Figure 19. The lower quartile, median and upper quartile of gross investment related to turnover by turnover class in 2008

Now the differences are not as clear as before, but even here the larger enterprises have dominated in the levels of investment (figure 20).

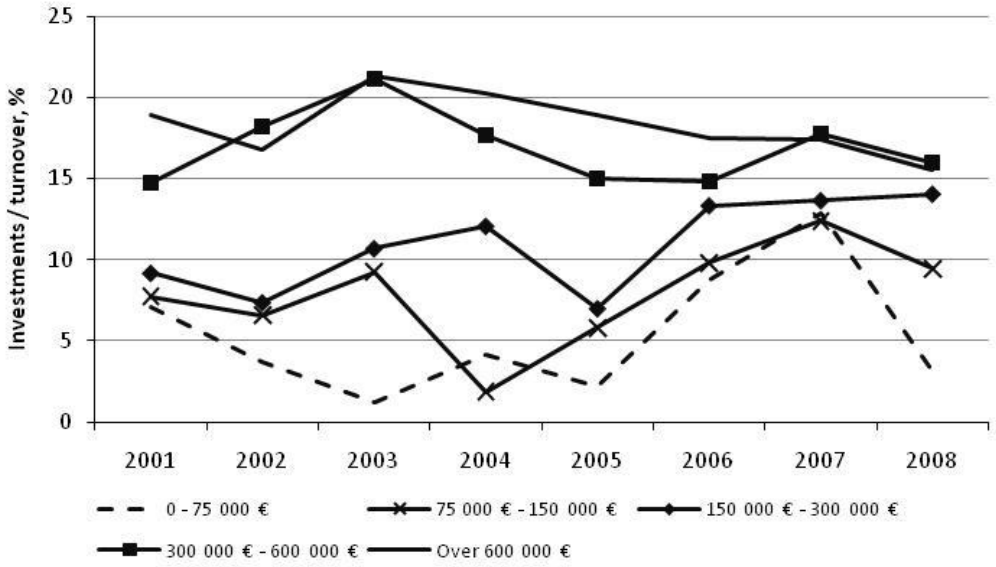

Figure 20. The medians of gross investment related to turnover by turnover class in 2001-2008

Financing result, which is fundamental for financing studies, clearly depicts the survival potential of an enterprise and has to be positive even in the short-term, otherwise a risk of bankruptcy emerges (CCA 2000, 2005). Recall that it is obtained by adding depreciation and reductions in value of fixed and other non-current assets to the net result.

Another approach is to look at the *equity financing share of investment*, by dividing the financing result by investment. This ratio suffers from clear conceptual and structural problems, because the denominator, the investment, may be small or even zero in some years. However, it does depict financial investment opportunities using the financing result and the investment behaviour of enterprises. Note that small amounts of investment may cause unrealistically high ratio values, but medians might give a better view of the investment behaviour, and here they show surprisingly small differences between the enterprise size classes (figure 21).

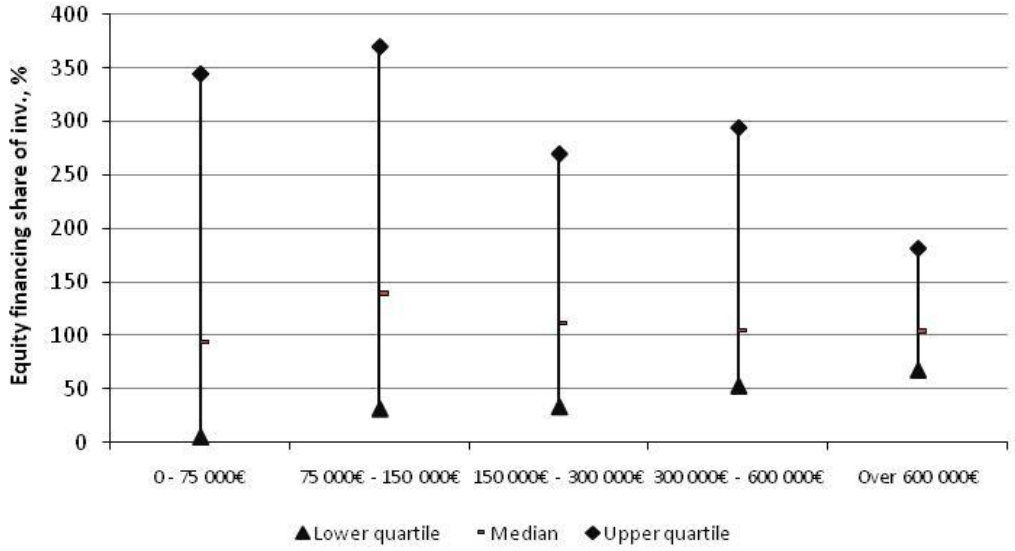

Figure 21. The lower quartile, median and upper quartile of the equity financing proportion of investment by turnover class in 2008

The financing result should cover (i) the scheduled amortisation, (ii) investment financed by internally generated funds, (iii) the increase in working capital and (iv) the dividends distributed to the owners. This leads to a kind of basic financing equation in considering the use of the financing result. The excess part, which is reserves, e.g., for enterprise growth, can be defined as follows: *Reserve* = financing result (as the starting-point) — instalments of debt (their net decrease) — self-financing part of investment — distribution of profit for one's own capital — addition of working capital. Here, only instalments of debt and financing of investment can be deducted from the financing profit to the *reserve*. This excess, the reserve, is the most revealing figure of an enterprise's growth. It could be used for the profit financing of one's own capital and for the expansion of the enterprise such as the addition of working capital and the growth of the firm. Its absolute value was a median of 12,000 €, at the zero level in the lower quartile, and 46,600 € in the upper quartile.

This ratio describes the real financial leeway, as well as management's potential to improve or extend the competitive edge of the enterprise. The reserve is the part of the financing result which shows how tight the situation of management actually is. This differed surprisingly clearly by turnover class. The reserve is first depicted in absolute values in various turnover classes to reveal the real opportunities of the enterprises (figures 22 and 23).

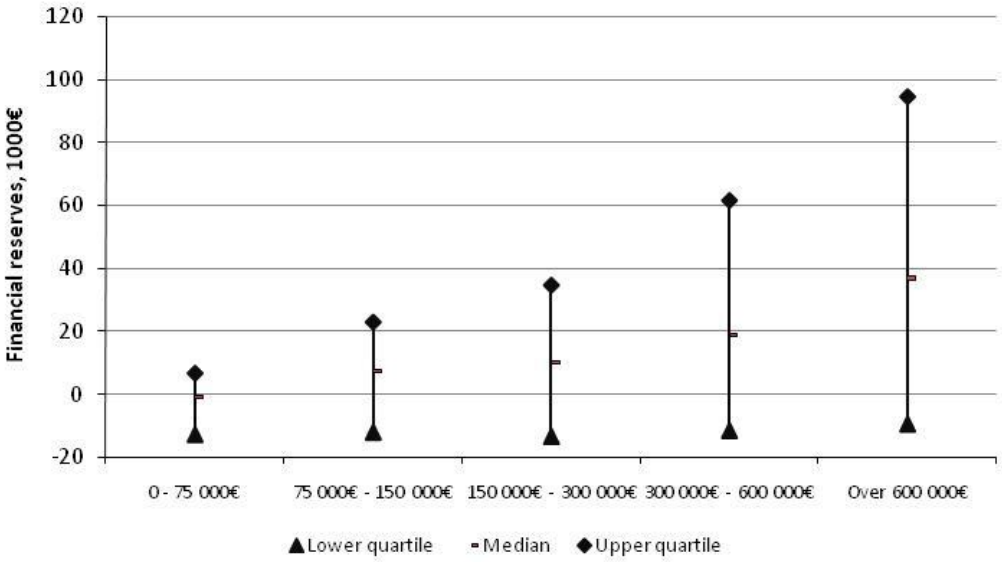

Figure 22. The lower quartile, median and upper quartile of the financial reserve by turnover class in 2008

The absolute median values grow, as could be expected with the turnover. The variation however also increases, and the lower quartile values, which all are negative, are not that different between turnover classes (figure 22).

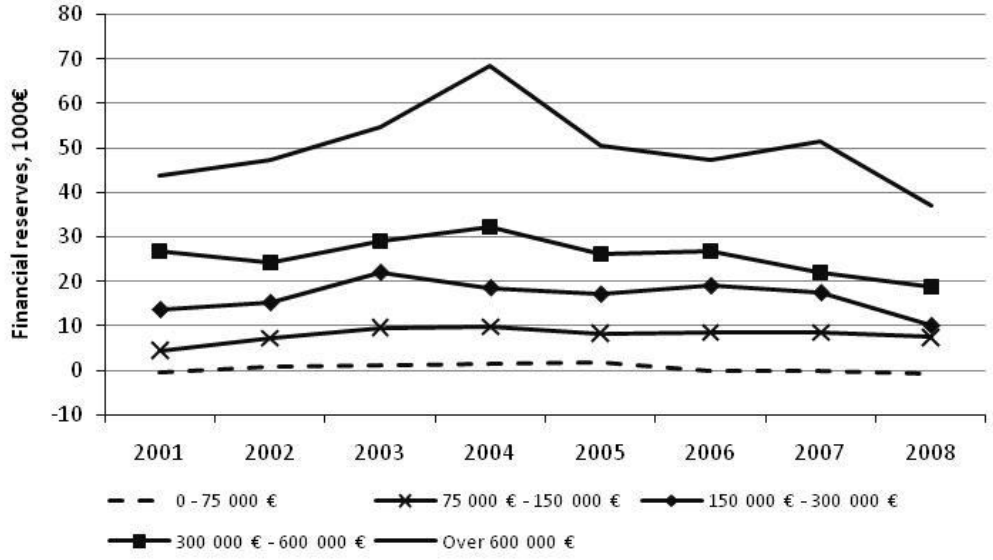

Figure 23. The medians of the financial reserve by turnover class in 2001 – 2008

Both the situation in 2008 and the trend in 2001-2008 demonstrate a surprisingly clear difference between the enterprise size classes. Moreover, one may ask whether, say, 40,000 € is a good beginning when buying a new, effective harvester. The reserve in relation to the financing result depicts the opportunities to manage the business in general (figures 24).

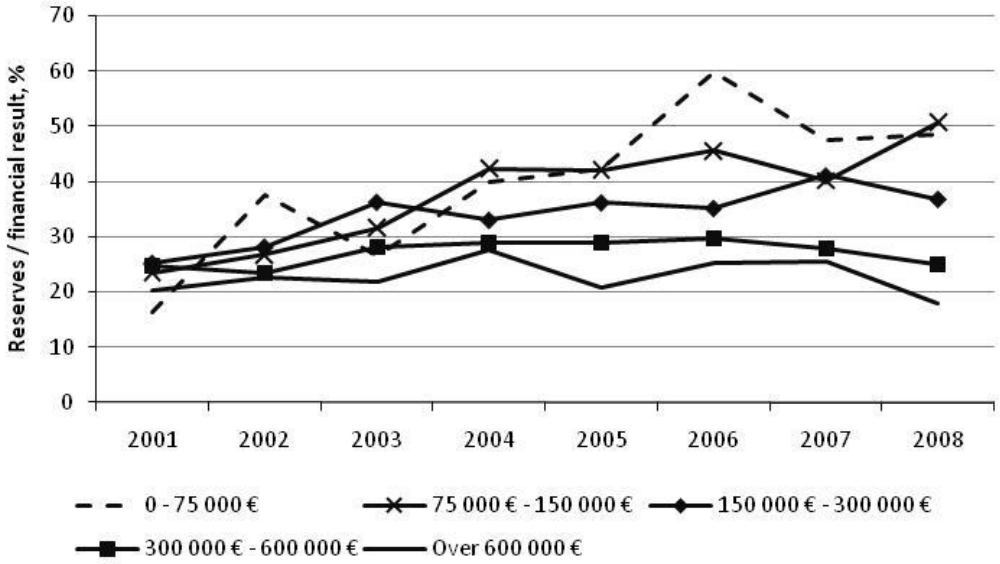

Figure 24. Medians of financial reserve in proportion to the financing result by turnover class 2001-2008

The relative reserve reverses the situation since the biggest companies have the smallest reserve in relation to the financial result. Surprisingly, the smaller ones improve their position and the bigger ones face deteriorating opportunities. The results are quite similar when the number of machines is used as the size classification factor. The biggest ones are again the weakest. Finally, distinctions in relative reserves were considered by enterprise form (figures 25 and 26).

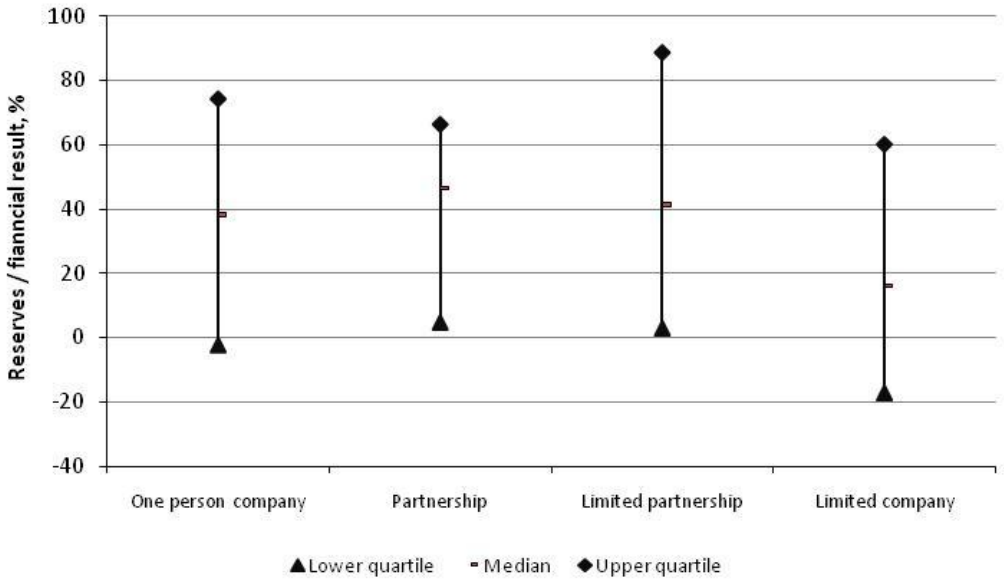

Figure 25. Lower quartile, median and upper quartile of financial reserve related to financing result by enterprise form in 2008

Limited companies include the bigger companies in the results in figure 25, which are in line with the previous results. Bigger companies have smaller relative financial reserves. Limited companies, although on average bigger enterprises, have clearly performed worse here than the others and even across the whole period (figure 26).

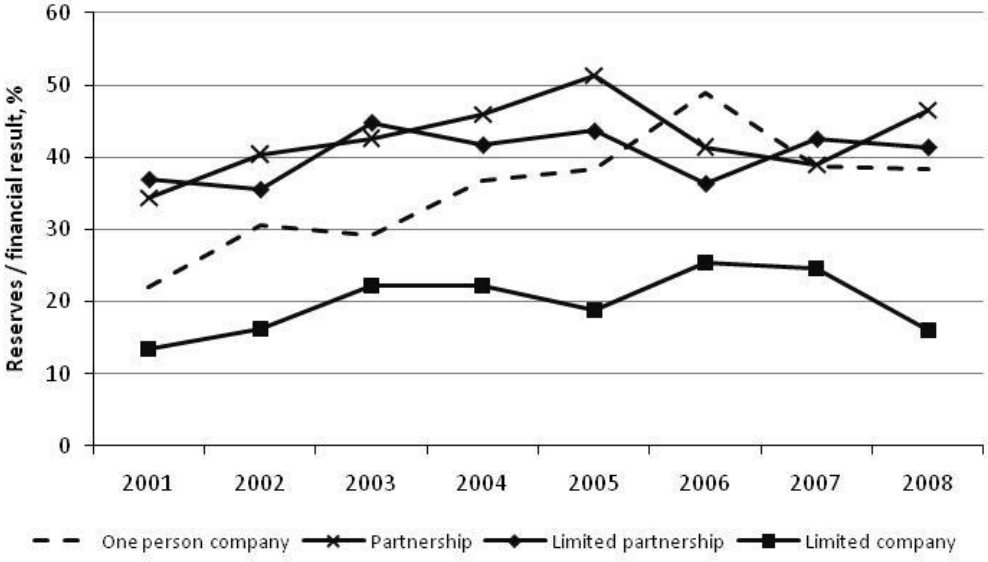

Figure 26. Medians of financial reserve related to financing result by enterprise form in 2001-2008

Investments in relation to turnover are narrative results, which depict management behaviour, and hardly indicate whether the business has been successful or not. However, reserves in euros clearly indicate the opportunities of an enterprise to cope with the various pressures. Reserves related to financing result depict in a size-corrected way how successful the business has been. Recall that many enterprises have even a negative financing result, which is a really challenging and sometimes even difficult if not hopeless situation.

5.2.3 Liquidity and survival times

The perhaps most common indicators of liquidity are quick ratio and current ratio, which differ in that the latter also recognises inventories and work-in-progress and is thus useless in a service business. The former relates the sum of financial assets and receivables in relation to short-term liabilities. This ratio was at a median level 0.6, 1.5 in the upper quartile and 0.3 in the lower quartile. Recall that a level exceeding 1.0 is good, 0.5-1.0 satisfactory and below 0.5 weak (CCA 2000, CCA 2005). Thus almost half the enterprises achieve only a weak level. A special feature of the wood-harvesting business is that some of the smallest enterprises have a very strong financial position. However, there are also more problem enterprises among the smaller than the the bigger enterprises. (figure 27).

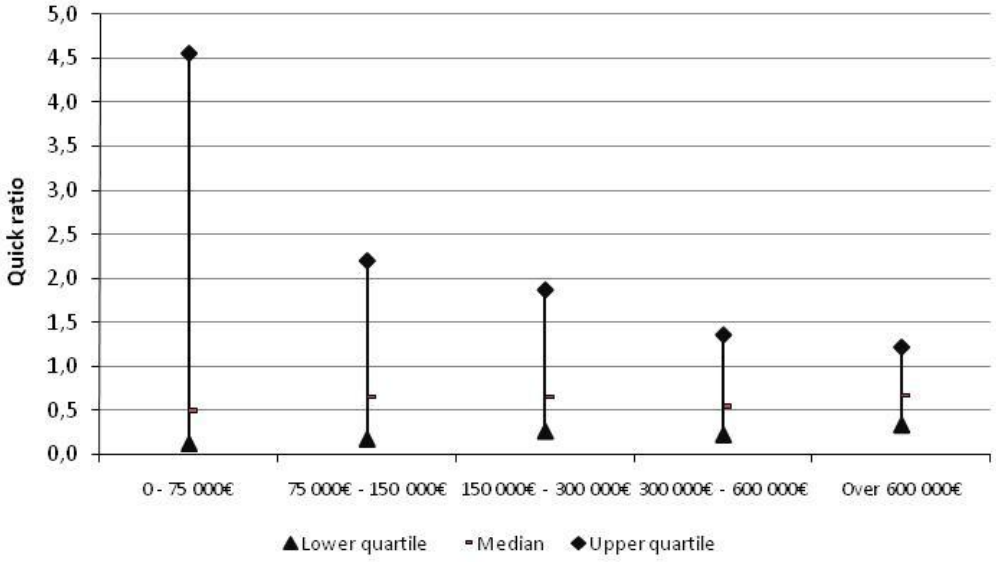

Figure 27. The lower quartile, median and upper quartile of quick ratio by turnover class in 2008

The medians by turnover class are quite similar, and vary just below or just above the weak level value of 0.5, although variation is large upwards in every class and huge in the smallest turnover class. The median of the quick ratio has been weak only among the smallest enterprises (figure 28).

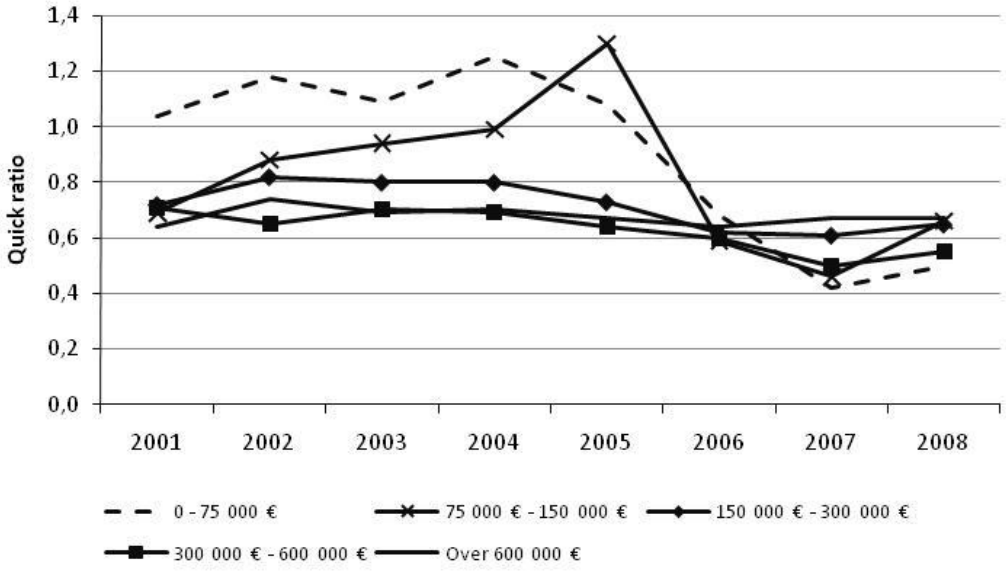

Figure 28. The medians of quick ratio by turnover class in 2001–2008

The medians of the quick ratio were close to 0.5 in 2007 and 2008, and have weakened continuously from 2001 to 2008. The median of the bigger companies has fallen steadily, but the real surprise is the dramatic weakening of the position of the smallest enterprises. All the classes seemed to have a slight improvement in 2008. The quick ratio approached a medianof 0.5 in the 1990s (Mäkinen 1993).

Accounts receivable will be managed differently in different enterprises and are influenced by the payment behaviour of the customers. When the accounts receivable are ignored, only the financial assets are related to short-term debts, and the cash ratio obtained then gives a better comparable picture of the financial situation of enterprise groups. The previous quick ratio results will now sharpen somewhat (figures 29).

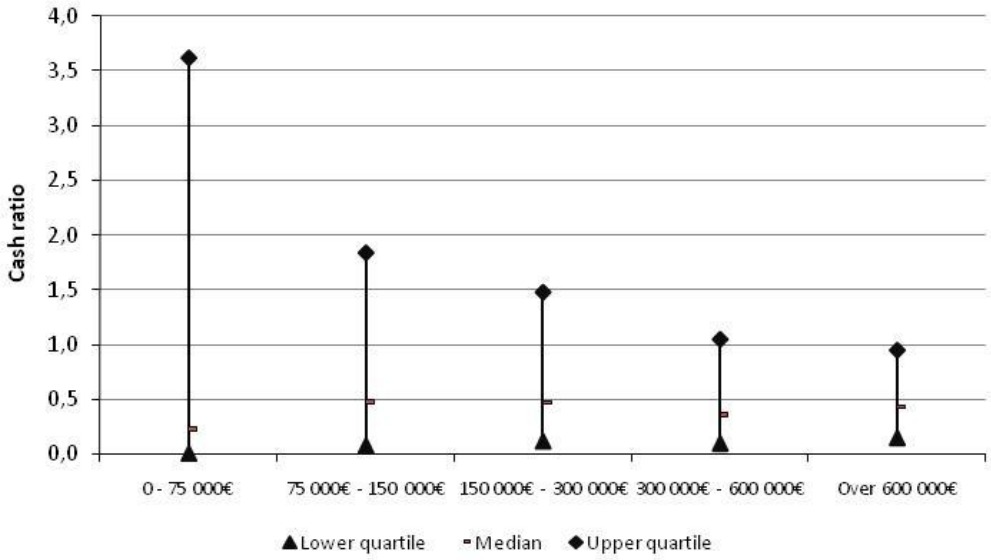

Figure 29. The lower quartile, median and upper quartile of cash ratio by turnover class in 2008

The median trend in the cash ratio has been quite stable except for a sudden rise for the two smallest enterprise classes in 2004-2005. However, the cash ratio level of the smallest enterprises systematically decreased from 0.5 to 0.7 until 2005 and to 0.2 or 0.3 thereafter. Nearly half of all enterprises face a challenging financing situation. As for the quick ratio results, the values of the cash ratios rose and fell for the smallest enterprises in the 2001-2008 period, but the situation has deteriorated for them even in 2008.

The previous indicators, quick and cash ratios, are only preliminary indicators describing the financial situation of the management that can be used to improve the competitive edge of the enterprise. The key question during the recession remains. What are the cost items which can and cannot be ignored or postponed? The cash burn rates, which indicate the cash needs, can be related to the financial resources of the firm. These ratios evaluate how long a company can survive without turnover before it needs refinancing. These key figures depict the chances of survival of an enterprise in difficult times. How many months or years will the firms survive before the business activities are completely stopped? In order to depict a more optimistic view it is assumed that the conditions of the long-term debt can be renegotiated. This survival question is answered in cases with and without temporary dismissal of the employees. The survival times are based on the closing of the books data in 2008.

The small enterprise typically has one big financier. Larger firms might even have different machines financed by different sources. The business planning of wood-harvesting SMEs suffers from the difficulty of forecasting the demand, especially in bad times. The market fluctuations and risks require good liquidity and solidity, which might be very different in the different enterprise sizes. Even if there was no demand for a while, at least interest expenses would remain. Moreover, personnel expenses would also remain if there were no dismissals, which require two different scenarios with and without dismissals. Depreciation could be used to approximate amortisation of the debt. Here, the optimistic approach into cash burn analyses has been chosen by assuming that the amortization programs can be renegotiated so that the estimated survival times do not underestimate business opportunities. Firstly, the impact of all expenses, except for amortization of long-term debt, will be ascertained (figure 30).

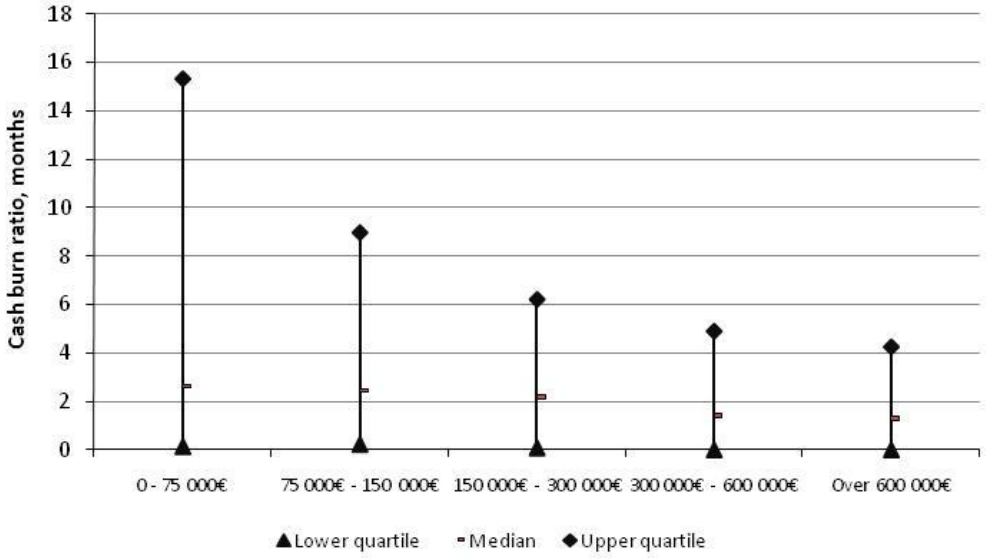

Figure 30. The lower quartile, median and upper quartile of the survival times when fixed expenditures, financing expenses, salaries and amortization of short-term debts are paid based on the closing of the books in 2008

The median of all companies was 1.8 months. However, the smallest enterprises usually do not pay wages, because entrepreneurs operate machines themselves, which distorts the comparison. The wage costs will also be ignored (figure 31).

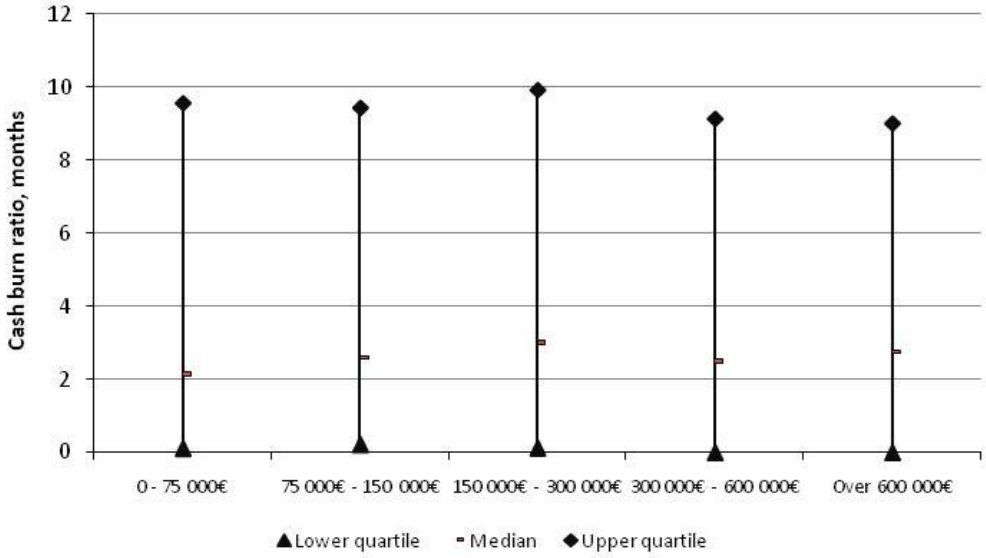

Figure 31. The lower quartile, median and upper quartile of the survival times when fixed expenditures, financing expenses, living expenses and amortization of short-term debts but no wages are paid based on the closing of the books in 2008

In this case, it is assumed that work force is laid off, but all companies pay living expenses for one owner. This lay-off – no salary option nearly eliminates the differences between enterprise classes (figure 31). Here the median is 2.7 months. In the third case, only fixed costs, financing costs and the amortizations of short-term debts are considered compulsory (figure 32).

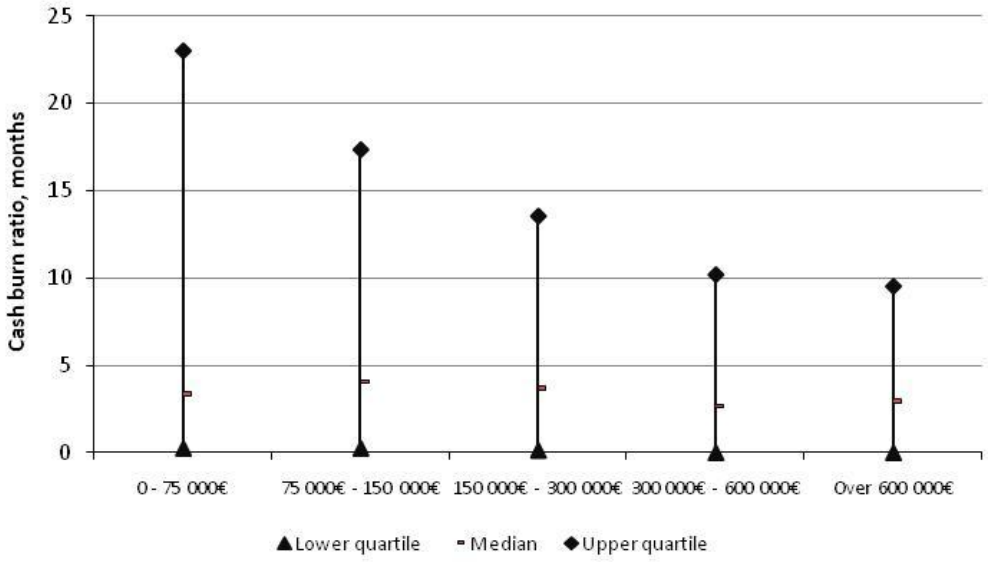

Figure 32. The lower quartile, median and upper quartile of the survival times when only fixed expenses, financing expenses and the amortization of short-term debts are included based on the closing of the books in 2008

The median is now 3.2 months. Both with and without wage payments, the median survival time is roughly two months, which can be considered alarming. However, if only fixed costs, financing costs and amortizations of short-term debt are recognized, the median survival time tends to approach 4 – 5 months, which is not a real improvement either. In a recession, most enterprises have to make rearrangement and even consider additional debt. Cash ratio as well as cash burn ratios 1 and 3 are relevant at both the aggregate and enterprise levels.

5.3 Capital structure

Ratios depicting capital structure consider assets and liabilities such as amounts of debt and equity capital. When advances received and cash and marketable securities are subtracted from the debt liabilities, and this received net debt is related to turnover, we obtain the net debt ratio results (CCA 2000, CCA 2005). It was at a median of 47.1%, 16.2% in the lower quartile and 88.0% in the upper quartile. In 2000, the same figures were nearly 65%, nearly 40% and 95% (Väkevä and Imponen 2001). The debt to turnover ratio (here 65.2%) was at roughly a 60% median in the 1980s and nearly 80% in the 1990s (Mäkinen 1988, 1993). Indeed, all these figures have decreased from 2001 to 2008. Here the differences in the net debt ratio by turnover class were quite dramatic (figures 33 and 34).

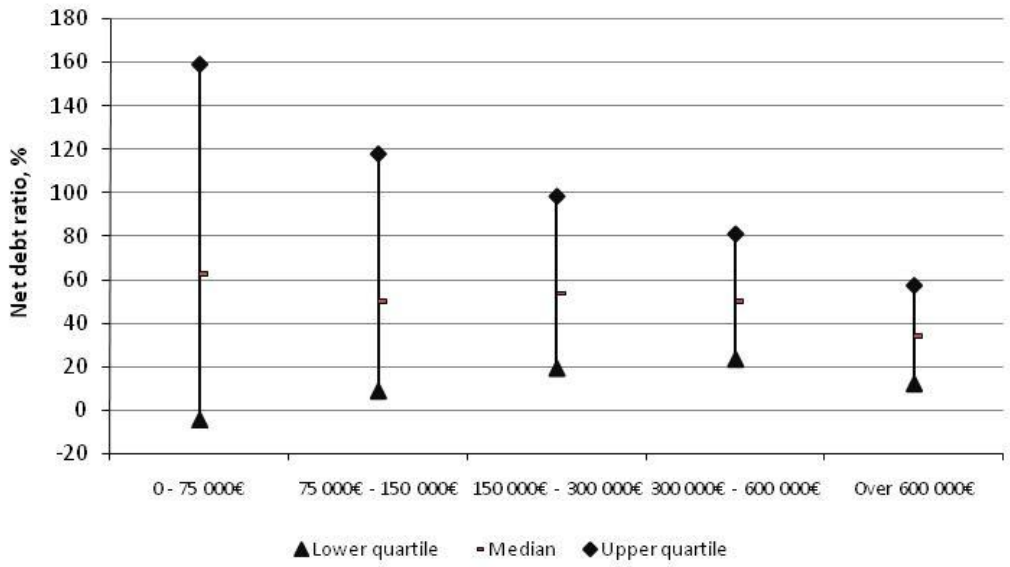

Figure 33. The lower quartile, median and upper quartile of the net debt ratio by turnover class in 2008

The variation in net debt ratio is greatest in the smallest enterprises; the larger the enterprise, the less the variation. The median net debt percent is over 60% in the smallest enterprises but less than 40% in the largest ones. It seems that the large enterprises are run with better economic knowledge and armed with better negotiating power (cf. Alajoutsijärvi et al. 2001).

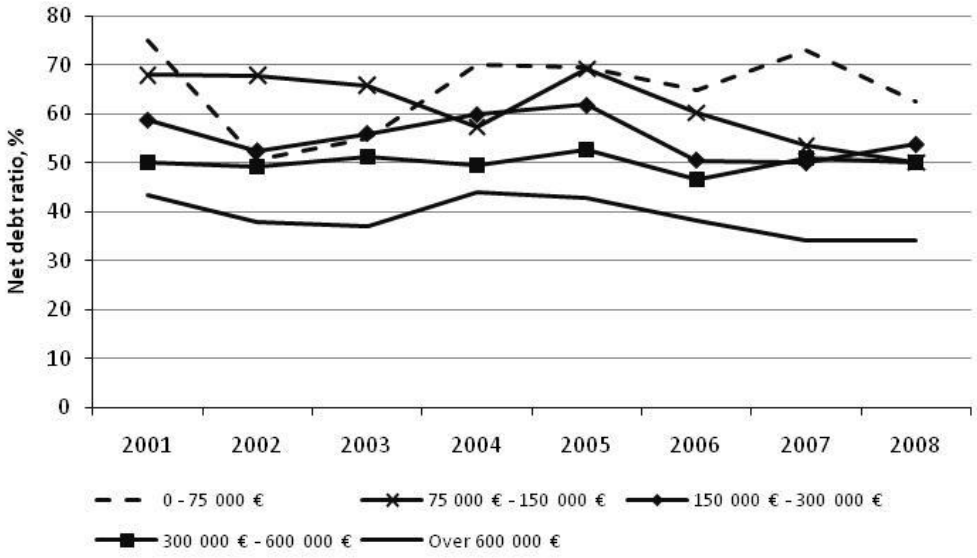

Figure 34. The median of the net debt ratio by enterprise turnover class in 2001 – 2008

Another ratio often used is debt to net sales, which is as above but without subtracting cash and marketable securities (CCA 2000, CCA 2005). However, the previous net debt ratio provides a more relevant picture because the amount of financial assets differs from one enterprise to another. On the other hand, ratios related to turnover are able to provide only a general view rather than identify the bottlenecks of the business. All in all, however, debt dominates business behaviour, especially in the smallest enterprises, and the distinction between the biggest ones and the others has persisted from 2001 to 2008 (figure 34).

A traditional measure showing whether the enterprise is financially healthy is the equity ratio, which is considered poor when below 20% (CCA 2000). The contractors, like SMEs more generally, in fact have usually quite modest equity ratio values. The traditional equity ratio can be considered in relation to the reserve of debt ratios. It is, however, a very crude indicator, especially in the case of other enterprises than the limited companies. For our data, the median was 18.7% at the zero level in the lower quartile and 49.9% in the upper quartile in 2008. Recall that equity ratio values exceeding 40% are considered good, and values from 20 to 40% satisfactory and values below 20% weak (CCA 2005). In 2000, the corresponding figures were 28%, 5% and 55% (Väkevä and Imponen 2001). The median equity ratio was roughly 20% in the 1980s and approached zero in the 1990s (Mäkinen 1988, 1993). Surprisingly, the results by turnover class did not show real differences in equity ratio. Only the lower quartiles tend to be negative and the variation was greater in the smaller enterprise classes (figures 35 and 36).

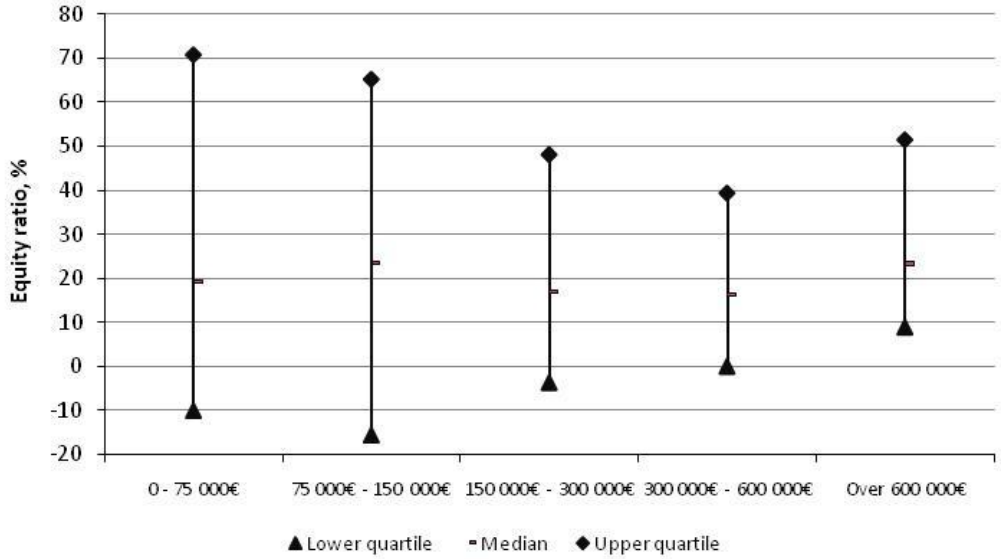

Figure 35. The lower quartile, median and upper quartile of the equity ratio by turnover class in 2008

The median of the equity ratio fluctuated around 20% for all turnover classes in 2008 (figure 35). The lower quartile was positive (9.0%) only in the biggest companies and only -15.4% for the class of the second smallest enterprises.

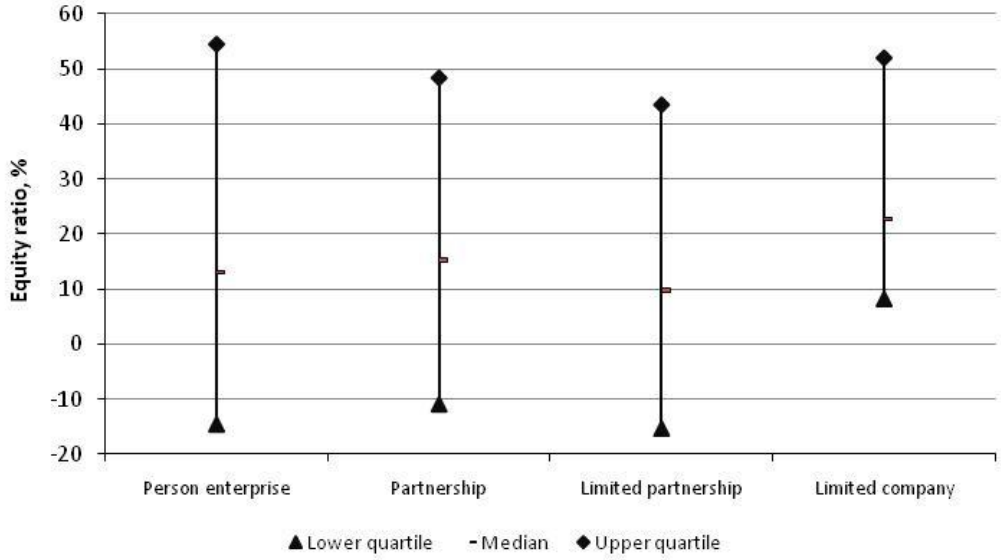

Figure 36. The lower quartile, median and upper quartile of the equity ratio by enterprise form in 2008

The median of equity ratio is already insufficient, especially with respect to risks such as recession and other changes in the marketplace. However, the largest companies and limited companies have a median clearly above the poor level of 20%. The limited companies also have a much higher median (22.7%) than other company forms, for which it varied from 9.7% to 15.3% in 2008 (figure 36). It also seems that the limited companies have tighter control of their equity because their lower quartile was clearly positive (8.2%), whereas it was even more clearly negative (from – 15.4% to -11.0%) for all other company forms. The equity ratio was already roughly from 20 to 25% in the 1980s (Mäkinen 1988). However, the median equity ratio of the biggest companies decreased from 50% to roughly 40% from 2001 to 2006 according to Soirinsuo and Mäkinen (2009a).

A very revealing indicator is the relation between net external financing and equity capital called net gearing, which is obtained by subtracting cash and marketable securities from external financing and dividing the difference by equity capital. Where this ratio is below one, it can be considered good. Where negative values are caused by negative equity capital, a negative value is weak (CCA 2005). Surprisingly, the median net gearing was negative in 2006 except for the largest enterprises, but clearly good in the upper quartile (3.1) in 2008. On the other hand, all the median values were under the good value of 1.0 during the whole period from 2001 to 2008 (figure 37).

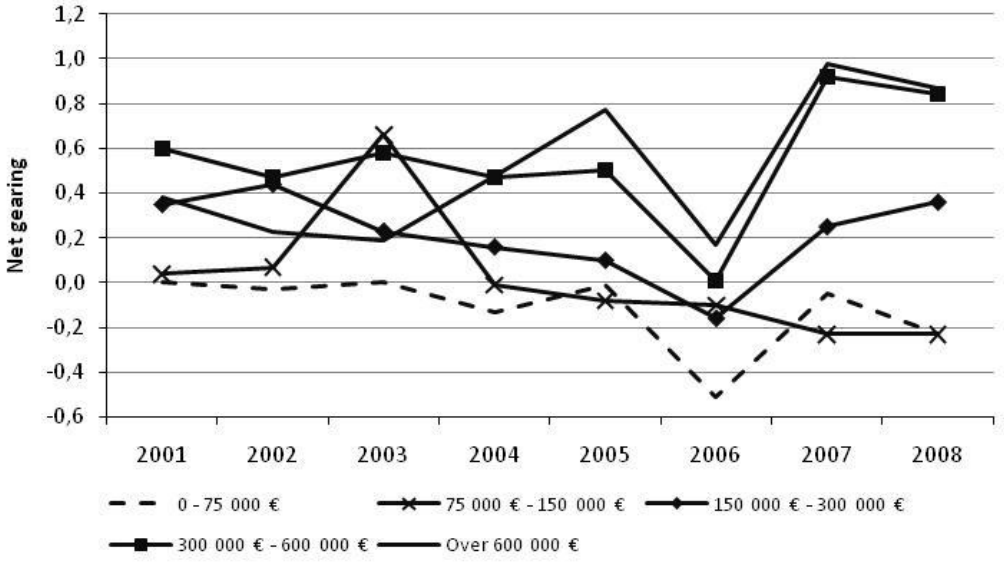

Figure 37. The medians of net gearing by turnover class in 2001 – 2008

In 2008, the two smallest groups had both the lowest medians and the least variation between the upper and lower quartiles. The variation increases with company size, especially in the third class, but the medians of the three bigger groups were positive. Only the biggest enterprises are approaching good levels, but the smallest ones even have negative medians, which is weak (CCA 2005).

The wood-harvesting business is very capital intensive because of investments in effective machines such as harvesters and forwarders. The capital turnover ratio, turnover related to average sum of the balance sheet, can reveal how effectively the investments were used. Remember that improving capital turnover has a direct impact both on the return on assets (ROA) and the return on equity (ROE).

The medians of the asset turnover ratio were surprisingly stable in all turnover classes in the period from 2001 to 2008. The upper quartiles do not differ all that much between size classes, but both the lower quartiles and the medians increased steadily with company size in 2008 (figure 38). The smallest enterprises could be expected to buy used machines and therefore have have less capital tied up in the business, but their capital efficiency has still deteriorated over the years. Size clearly seems to improve efficiency in use of capital. One explanation might be that the bigger enterprises have newer machines and use these machines in two shifts.

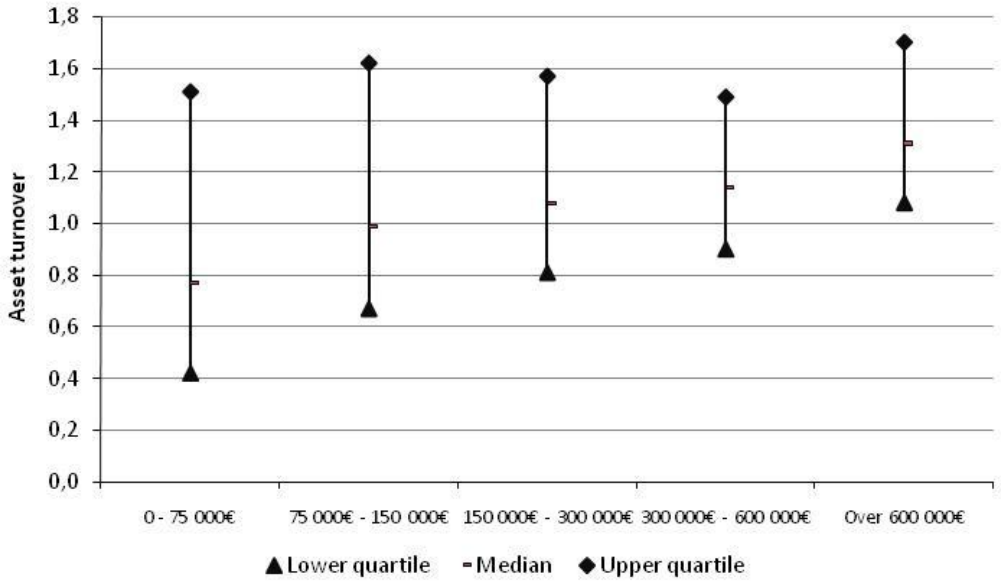

Figure 38. Lower quartile, median and upper quartile of asset turnover ratio by turnover class in 2008

Net working capital consists of inventories and work-in-progress and other short-term current assets minus short-term liabilities. Other short-term current assets consist of cash and marketable securities and short-term receivables (CCA 2000). The net working capital is usually related to sales in order to eliminate the size effect of the enterprise. Here, even its median was negative (-6.2%), while the upper quartile was 9.1%. All the items of working capital are small in this sector and current assets nearly non-existent. The amounts of net working capital are therefore typically small and can hardly differentiate between success and failure of the enterprises even though the situation seems to have worsened at least temporarity for three of the five turnover classes in 2006 and 2007 (figures 39).

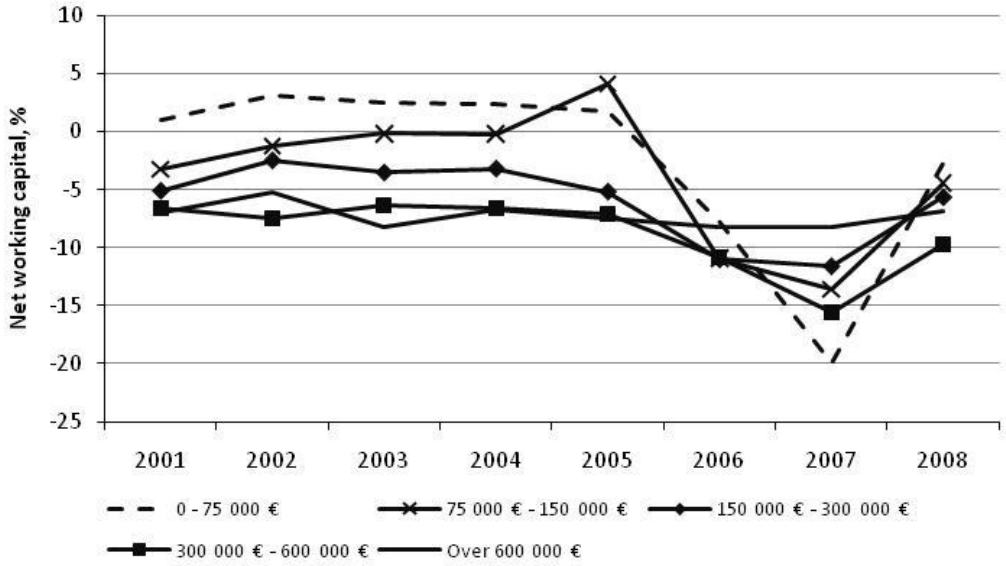

Figure 39. Medians of net working capital by turnover class from 2001 to 2008

The impact of 2007 has been dramatic for three of the five turnover classes. The sudden drop was probably caused by the increase in the short-term liabilities (i.e., debt). In 2008, the lower quartiles increased and the upper quartiles decreased with the enterprise class. The short-term debt tended to exceed financial assets, which caused negative working capital. This relation could be considered typical in the wood-harvesting business.

Finally, we focus on the financial leverage. The DuPont identity shows that ROE is the product of ROA and leverage expressed as total assets to total equity (As-

trachan and McConaughy 2001). Debt funds "leverage" the ROE funds by magnifying both positive and negative returns. When ROE exceeds ROA, business gives a better yield than the capital requires and vice versa. On the other hand, although a heavy debt burden can result in big profits because of high ROE in the good years, it can also be considered a high risk factor as ROE deteriorates in the bad years.

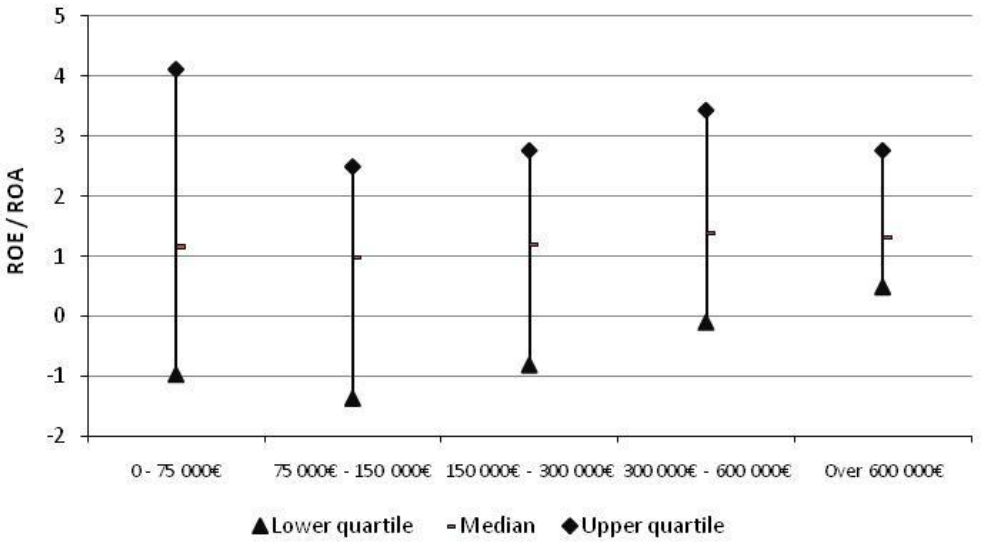

Figure 40. The financial leverage ratio by turnover class 2008

The financial leverage has been quite stable over the period from 2001 to 2008, except for the smallest enterprises, which started at 0.8 in 2001 and ended at 1.2 in 2008. Similarly, the second smallest group moved from 0.8 to 1.0.

When the financial leverage ROE / ROA is less than one, the business yields less than the interest rate cost of the debt. Loosely speaking, the business then destroys its own capital. The differences between the turnover classes were not all that big in 2008, but it is quite surprising that almost half of all the companies had a leverage value below one.

6. STATISTICAL ANALYSIS

6.1 Relevant and irrelevant variables

Statistical analyses of the variables of the closing of the books and financing ratios requires limiting the number of variables included. Many variables are multicollinear and some are nearly so. Recall that the profitability is the best predictor of a firm's performance, at least in the longer term (Brozik 1984). The net result here or, more precisely, the net result divided by turnover, represents one profitability measure. For financing consideration, the financing result is also needed. The other sum levels of the profit and loss statement such as gross margin on sales, operating margin (earnings before interest, taxes, depreciation and amortization EBITDA), operating result (earnings before interest and taxes, EBIT), total result or result for the fiscal period will be ignored and differences between these results will be focused on instead.

Materials and supplies might be interesting, but these items are compulsory, hardly differ essentially between enterprises, and in any case, management cannot affect the levels of these items much. The level of the *outsourced services* depends on the policy of the enterprise on hiring services or not. By contrast, the sum of *personnel expenses* and *adjustment to the entrepreneur's salary* depicts essential management behaviour. *Other operating expenses* stand for recording of very different expenses. This is heterogeneous and suffers from the unfamiliarity of more detailed content. *Depreciation and reductions in value of fixed and other non-current assets* together reveal the investment policy of the management. Finally, *financial expenses* is needed to include the impact of the consequences of various financial policies. The turnover is a natural scaling of variables from the profit and loss statement to guarantee that the results can also be communicated to entrepreneurs and enterprise organisations.

Balance sheet items such as *fixed assets* or, alternatively, the *book value of machines* and *financial assets* are relevant. The *equity capital* as such might be an ill-defined item, however, especially in the smaller one-person enterprises, but the *invested capital* would be interesting to look at. Moreover, *all the liabilities* together form a key measure. Last but not least, *the addition of fixed assets*, or the *addition of the value of machines* in the balance sheet during the fiscal year shows the investment behaviour of the entrepreneur. The following balance sheet items could be included in more careful statistical analysis: *equity, assets and total investment*. Although equity is a bottle-neck resource, it is an imprecise item, especially in the smaller companies and partnerships. Neither total assets nor total

investment is a critical or bottle-neck resource. The total sum of the balance sheet is a natural scaling of variables chosen from the balance sheet.

6.2 Correlation

The correlation between the success variables and other ratio variables surprisingly showed that not only financial and other expenses but also such things as reserves / financial result correlated negatively with success variables. Obviously, net debt percentage and all expense items correlated negatively as well (Table 2).

Table 2. Correlation between success variables and other ratio variables by using the closing of the books data in 2008.

Variable	Operating marg. (%)	Operating profit (%)	Net result (%)	ROA	ROE	ROI	Financing result (%)
Operat. margin (%)	1.00						
Operat. profit (%)	0.88***	1.00					
Net result (%)	0.72***	0.84***	1.00				
ROA	0.27***	0.36***	0.33***	1.00			
ROE	0.02	0.03	0.03	0.01	1.00		
ROI	0.22***	0.28***	0.26***	0.69***	0.01	1.00	
Financing result (%)	0.82***	0.71***	0.89***	0.24***	0.02	0.20***	1.00
Payback period	-0.05*	-0.04	0.03	0.00	0.00	-0.01	0.02
Inter. rate coverage	0.06**	0.06**	0.06*	0.02	-0.00	0.01	0.05*
Fin. exp. / Op. marg.	-0.06*	-0.03	-0.03	-0.04	-0.00	-0.03	-0.06**
Quick ratio	0.07**	0.06**	0.04	0.02	-0.00	0.01	0.05
Cash ratio	0.07**	0.06**	0.04	0.01	-0.00	-0.00	0.05
Reserves	0.24***	0.27***	0.26***	0.13***	0.03	0.12***	0.24***
Reserv. / Fin. result	-0.07**	-0.05	-0.05*	-0.06**	-0.00	-0.02	-0.08**
Invest. / Turnover	0.09***	0.07**	0.06**	0.01	0.08***	0.01	0.08***
Net debt (%)	-0.05	-0.03	-0.09***	-0.02	-0.08***	-0.02	-0.11***
Equity ratio	0.05*	0.06*	0.08***	0.36***	-0.00	0.04	0.08***
Net gearing	-0.02	-0.00	-0.00	-0.01	0.20***	-0.01	-0.02
Capital turnover	-0.02	0.04	0.06**	0.45***	-0.01	0.68***	0.00
Net working capital	-0.25***	-0.26***	0.17***	0.01	0.00	0.01	0.20***
Materials / Turnover	-0.27***	-0.21***	-0.16***	-0.10***	-0.00	-0.07**	-0.21***
Services / Turnover	-0.18***	-0.10***	-0.04	-0.08**	-0.00	-0.05*	-0.12***
Wages / Turnover	-0.52***	-0.45***	-0.19***	-0.17***	0.01	-0.12***	-0.24***
Other exp. / Turnov.	-0.44***	-0.45***	-0.52***	-0.07**	-0.03	-0.08***	-0.51***
Deprec. / Turnover	0.15***	-0.33***	-0.31***	-0.21***	-0.03	-0.15***	0.15***
Fin. exp. / Turnover	-0.13***	-0.23***	-0.54***	-0.11***	-0.01	-0.09***	-0.46***

Notations *, ** and *** indicate that the non-existence of correlation can be rejected by 5%, 1% and 0.1% risk.

The correlation coefficients give only a preliminary picture of the relationships between the variables. More detailed results can be obtained by performing principal component and factor analyses.

Financing theories include the idea of an optimal level of debt financing and optimal investment behaviour. The net result percentage here correlates statistically significantly and positively with investment related to turnover and significantly and negatively with the net debt turnover. Moreover, it correlates significantly and positively with net working capital. The capital turnover standing for turnover divided by total assets also correlates significantly and positively with net profit percentage, ROA and ROI, which suggest that investment should be related and limited to actual needs. Surprisingly, getting ready for the bad times in the form of net working capital and quick ratio also relates positively to the net profit percentage, although one might consider it costly and a burden on the net result. Equity ratio, i.e., equity capital related to total assets, correlates positively and clearly statistically significantly with both net result percentage and ROA. All the expenses of the profit and loss statement correlate negatively and statistically significantly with all success variables, but the financial expenses divided by turnover has the highest negative correlation with net profit percentage, which further militates against debt financing.

6.3 Principal component and factor analysis

A multidimensional data set, even with dozens of relevant and correlating variables, can be further studied by applying principal component analysis (PCA), which provides a roadmap of how to reduce a complex dataset to a lower dimension to reveal the sometimes hidden, simplified structure that often underlies it. In PCA, the possible internal structure of data is revealed by doing a linear transformation to the original data, by seeking orthogonal principal components aligning the transformed axes with the directions of maximum variance (Shlens 2009). In our analysis, the use of the mineigen criterion led to a PCA solution with seven factors (table 3).

Table 3. The principal component analysis solution of wood-harvesting enterprises closing the books in 2008.

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Operating margin (%)	**0.829**	-0.211	-0.116	-0.391	-0.022	-0.004	-0.042
Net result (%)	**0.850**	-0.165	-0.052	-0.338	0.020	-0.033	-0.028
ROA	**0.522**	-0.313	0.354	0.397	-0.004	0.029	-0.073
ROE	0.055	-0.006	-0.143	0.065	**0.683**	0.308	-0.056
ROI	0.472	-0.386	0.442	**0.567**	0.000	0.018	-0.009
Financing result (%)	**0.844**	-0.191	-0.116	-0.423	-0.018	-0.014	-0.049
Inter. rate coverage	0.122	0.175	0.017	0.011	-0.258	**0.598**	0.243
Quick ratio	0.225	0.494	0.051	0.091	-0.115	0.144	-0.201
Reserves	0.365	-0.013	0.012	-0.079	0.169	-0.110	**0.627**
Reserves / Fin. result	-0.008	0.268	0.084	0.100	0.170	-0.254	**0.694**
Investm. / Turnover	0.193	-0.093	**-0.855**	0.461	-0.068	-0.026	0.025
Net debt (%)	-0.200	0.080	**0.852**	-0.467	0.068	0.029	-0.023
Net gearing	-0.014	0.002	-0.036	0.017	**0.699**	0.338	-0.096
Capital turnover	0.225	-0.332	0.403	**0.628**	-0.014	0.004	0.013
Net working capital	0.397	**0.641**	0.038	0.156	0.059	-0.155	-0.051
Cash burn ratio 1	0.089	0.146	0.013	0.001	-0.297	**0.684**	0.232
Cash burn ratio 2	0.361	**0.784**	0.096	0.171	0.038	-0.115	-0.098
Cash burn ratio 3	0.352	**0.725**	0.082	0.143	0.020	-0.020	-0.119

The correlations between a factor and a variable exceeding 0.5 in absolute value have been highlighted by bold figures.

PCA performs a variance-maximising rotation of the variable space, thus taking into account all variability in the variables. However, factor analysis (FA) estimates how much the variability is due to so-called common factors. The most widely-used method in defining the solution of an FA is the varimax rotation, suggested by Kaiser (1958), which maximises the variance of the squared loading of a factor on all the variables of a factor matrix.

Table 4. The factor analysis solution of wood-harvesting enterprises closing the books in 2008.

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Operating margin (%)	**0.943**	0.042	0.077	0.052	0.029	-0.005	0.014
Net result (%)	**0.914**	0.106	0.133	0.021	0.003	0.015	0.058
ROA	0.260	0.052	**0.767**	-0.009	0.009	0.012	-0.023
ROE	0.025	0.008	0.002	0.086	-0.004	**0.764**	0.026
ROI	0.136	0.001	**0.933**	-0.001	0.004	0.003	0.032
Financing result (%)	**0.967**	0.060	0.053	0.037	0.021	-0.007	0.015
Inter. rate coverage	0.026	0.092	0.004	0.003	**0.720**	-0.003	0.041
Quick ratio	0.027	**0.566**	-0.006	-0.008	0.189	-0.020	-0.152
Reserves	0.306	-0.014	0.071	0.019	0.069	0.044	**0.684**
Reserves / Fin. result	-0.165	0.134	-0.029	-0.027	-0.025	-0.030	**0.785**
Investm. / Turnover	0.049	0.002	0.005	**0.997**	0.002	0.027	-0.006
Net debt (%)	-0.049	-0.017	-0.008	**-0.997**	-0.001	-0.026	0.004
Net gearing	-0.021	-0.005	-0.006	-0.044	0.000	**0.781**	-0.018
Capital turnover	-0.106	-0.039	**0.839**	0.022	-0.009	-0.017	0.030
Net working capital	0.099	**0.766**	0.025	0.050	-0.051	0.002	0.148
Cash burn ratio 1	0.011	0.046	-0.002	-0.001	**0.798**	0.000	-0.010
Cash burn ratio 2	0.023	**0.892**	-0.002	-0.010	-0.006	-0.002	0.107
Cash burn ratio 3	0.044	**0.826**	-0.005	-0.012	0.067	0.025	0.048

The correlations between a factor and a variable exceeding 0.5 in absolute value have been highlighted by bold figures.

The PCA and FA solutions are very similar; indeed nearly identical (table 4). The biggest difference can be found in the order of some factors. The varimax solution of the factor analysis is used here as the base result for further considerations.

Both analyses suggest the following factors (in parenthesis the correlations between the factor and net result percentage and ROA):

1) Economic success (0.91, 0.26)

2) Short-term liquidity (0.11, 0.05)

3) Return on capital (ROI, ROA) and capital turnover (0.13, 0.77)

4) Investments (0.02, -0.01)

5) Interest expense coverage (0.003, 0.01)

6) Return on equity (ROE), net gearing (0.02, 0.01)

7) Reserves (0.06, -0.02)

Surprisingly, the investments factor has a very high negative correlation (-0.997) with net debt percentage, which suggests that an enterprise with a heavy debt load

finds it difficult to invest. The economic success factor hardly correlates with ROA (0.26) or capital turnover (-0.1), both of which measure success in the use of available assets. Interestingly, the investment factor does not support economic success, i.e., net result (0.02) or ROA (-0.01). Debt is negatively correlated everywhere except for a small positive correlation with the reserves factor (0.004). Summarising the results, one could argue that investment might have some slight positive effect on economic success, but debt can be seen only as negative phenomenon.

7. CONCLUSIONS

Forest-harvesting contractors have been responsible for the industrial round wood harvesting in Finland for over forty years already (Högnäs 2000, Uusitalo & Markkola 2006). Today, the forest industry customers prefer negotiating with fewer forest contractors who might have subcontractors (Rekilä & Räsänen 2008). The cost-effectiveness of the harvesting by few bigger enterprises, often called key or area enterprises, compared with more numerous smaller enterprises, has been studied without a clear answer so far (Matilainen 2007).

Forest industry conglomerates have decided to concentrate their service purchases and offer larger contracts and responsibilities, which has moved the focus onto growth research (Soirinsuo & Mäkinen 2010). In any case, business expansion requires knowledge of management, as well as leadership skills, both of which often seem to improve profitability (Soirinsuo & Makinen 2009b). The average net profits of 23 large harvesting enterprises nevertheless decreased from 6% to 4% between 2004 and 2006 (Soirinsuo & Mäkinen 2009a). The intention of big industry customers to use the services of larger harvesting enterprises may thus also lead to lower profits.

Empirical studies suggest that real-world entrepreneurs may not be profit maximisers; being constrained by limited business acumen, they may be content to achieve a satisfactory economic result – the so-called *satisfying principle* (Earl 1983). This might limit both the risk-taking and growth. The present study demonstrates, however, that entrepreneurs have invested and taken on more debt than would have been optimal to maintain profitability. On the other hand, many entrepreneurs seem reluctant to grow their business and therewith to accept additional risks.

Both entrepreneurs and the Finnish accounting scholars have traditionally favoured profitability and focused on the profit and loss statement and thus net result. In the USA, both accounting practice and theory have, however, focused on the balance sheet and favoured ROI-type measures. The new *International Financial Accounting Standards* (IFRS) of the EU represent the American approach. Even the Finnish forest industry companies have chosen the return on capital employed (ROCE) as the indicator of success (Stora Enso 2007). This raises the question of whether effective capital usage is considered the main target in forest industries, but is not even necessarily recognised in the wood-harvesting enterprises.

The empirical data utilised in here (some 1,000 closings of the accounts for eight years) has allowed testing of the ratios proposed by CCA (2000, 2005) and many

others. All the ratios described provide a clear picture of the financing of the wood-harvesting business. Moreover, the most relevant ratios have been selected and recommendations provided. Factor analysis disclosed that economic success in the form of net result percentage and ROA are, although correlated (0.33), quite different measures.

Recall the basic equation (1) according to which return on equity (ROE) can be decomposed into profit margin, capital turnover and leverage. Although the ROE is problematic, especially in the smaller enterprises, the basic equation focuses on valuable points of interest. All the variables and indicators supporting the profit margin are of relevance. It should be maximised, and so should the capital turnover as well. Investment is a critical issue and efforts should be targeted to obtaining service contracts. On the other hand, leverage is a very elaborate issue. Investing with debt supports profitability only as long as the business yields more than the interest rate of debt capital. Moreover, the debt capital increases financial risk in the bad times.

The factor analysis found several independent factors such as: (i) profitability, (ii) short-term liquidity, (iii) returns on investments and assets (ROI and ROA) and capital turnover, (iv) investment, (v) interest expenses coverage, (vi) return on equity (ROE) and net gearing and (vii) reserves. The ratios supporting ROA were reserves, the equity share and capital turnover. Surprisingly, the net profit percentage was also positively correlated with the investments / turnover and net working capital.

The interest expenses coverage tends to improve when the enterprise size increases and the financial expenses related to operating margin reveal the better position of the bigger enterprises and the worse position of the smaller. The paid interest rates also deviate in the same way, as the median is less than 4.0% for the biggest and more than 5% for the smallest enterprise class. The debt burden, e.g., net debt ratio and repayment period, are relevant indicators at the enterprise level. Moreover, working capital and even financial leverage would be interesting indicators at the enterprise level.

The differences in the level of investment is even more striking because they are next to nothing among the smaller enterprises and nearly a median of 200,000 € among the largest enterprises. However, investment related to turnover hardly reveals differences between enterprise size classes except for the smallest ones being consistently weaker than the rest. Similarly, the median of the equity financing share hardly shows any difference between the size classes, but the variation becomes smaller with enterprise size. The financial reserve clearly increases with enterprise size both as a median and in variation. Interestingly, the reserve in

relation to financing result is clearly lowest in the limited companies. Moreover, the financial reserve has turned out to be the best available measure to describe the opportunities of the enterprise to grow and cope with the new challenges.

The quick ratio, the cash ratio and the survival time rates with several possible deduction combinations were analysed for the liquidity and survival time study. Note that the amortization of long-term debt was assumed to be postponed in all of the survival time calculations. The median quick ratio has been satisfactory in all of the enterprise classes, but almost half the companies had a weak value in 2008. The medians have also deteriorated since 2005, especially in the two smallest enterprise classes. This trend is even clearer with the cash ratio. Survival times differ in enterprise size classes clearly and systematically, so that when the wages are included, the larger the enterprise class the greater the variation. The median does not change that much, dropping from above two months to below two months as the size class gets bigger. If the wages are replaced by the living expenses (for all the companies), practically no differences can be found between the size classes. Where both wages and living expenses are ignored, the survival time structure in different size classes is nearly similar to the first case but roughly in double the number of months.

The capital structure study suggests the use of net debt ratio as the key indicator of a healthy business. This ratio improves and the variation gets smaller with the increase in the enterprise size. The medians varied between 34% (the biggest turnover class) and 63% (the smallest size class) in 2008. The median of the equity ratio fluctuates around 20% for all the turnover classes, but the variation is much greater in the smaller classes. The limited companies also had a higher median (22.7%) than other company forms, for which it varied from 9.7% to 15.3% in 2008. It also seems that the limited companies have tighter control of equity, since their lower quartile of equity ratio was clearly positive, whereas it was even more clearly negative for all the other company forms.

The median net gearing of the two smallest groups are on the negative side already, and can thus hardly be of use in the analysis. The turnover in relation to the average sum of the balance sheet, capital turnover ratio, improves systematically from smaller enterprises to larger enterprises. It is a key indicator describing the effectiveness of the use of resources. By contrast, the net working capital by turnover ratio tends to be negative in all classes in 2008 and is hardly of any practical use. However, the financial leverage effect in returns, ROE / ROA, describes whether the foreign capital is a blessing or a curse well. In our study, ROE does not differ on average very much from ROA since the medians of the ROE/ROA are just above one in all the turnover classes. This means that in more half of the

companies there is an opportunity for leverage gains, at least in theory. This also means, however, that the return on of equity (ROE) is smaller than the average cost of capital in almost half the companies. Many smaller companies also have negative equity, which is manifested in the clearly negative lower quartiles in the first three turnover groups (turnovers less than 300,000 €).

The correlation analysis of the roughly 1000 closings of the books in 2008 suggests that all the major profitability ratios, like the net profit percentage and the return on assets (ROA), are negatively correlated with the net debt percentage, but correlated positively with equity share and capital turnover, for example. On the other hand, the investments by the turnover and net working capital relate positively to profitability, but in most cases also require more debt. Investments, reserves and net debt percentage are the most revealing ratios illustrating investment behaviour. Moreover, cash ratio, survival times one and three, and net gearing clearly show short-term liquidity.

The empirical evidence from the Finnish companies suggests the application of efficiency and marketing improvement strategies for companies in financial troubles (Laitinen 2000). The second of these has already been demonstrated by Mäkinen (1993) in the form of good customers and good contracts. The first one can be supported by this study. A key concept of efficient investment is the debt leverage, which means that where the business yields less than the debt interest rate, the debt gradually destroys the company's own capital.

The effect of the growing number of larger enterprises cannot yet be seen in the total number of enterprises. The number of forestry and harvesting enterprises has been slowly growing, from 4,281 to 4,711 during 2005-2009 (Aloittaneet ja … 2011). Excluding 2006, the number of new enterprises has been larger than the number of enterprises being wound up throughout the whole period. Unfortunately, since the statistics also include forestry planning and silviculture enterprises, it is not possible to see clearly the effect on harvesting enterprises only.

8. FUTURE RESEARCH

Critical success and failure factors are the main lines of interest in studying timber-harvesting enterprises. What ratios and variables explain success, say, the profit margin or ROA? What is the optimum financing policy? Could investment analyses be focused using enterprise case material? Moreover, the deeper cost accounting and cost structure analysis of timber-harvesting enterprises would be beneficial, if not necessary, for an enterprise submitting a tender for a new contract. In all, decisions leading to the behaviour favouring success and avoiding mistakes would be a useful direction for future research.

The industrial customers of wood procurement enterprises have in recent years favoured the creation of key / areal / wide-responsible entrepreneurs, which have several subcontractors or form a network with smaller entrepreneurs. Systematic Network Financial Statement Analysis (NFSA) for SMEs has already been developed by Laitinen (2006). A focus of further studies could be applying network financial analysis to wood-harvesting enterprises.

Graphical data analysis of all the roughly 1000 closing of the books in 2008 suggests that the profitability – both net profit percentage and the return on assets (ROA) – deteriorate when the net debt percentage increases. On the other hand, investment improves profitability first and then decreases it. These findings of the data analysis performed suggest the search for optimal investment and financing behaviour for a wood-harvesting enterprise. Moreover, using assets more effectively as suggested by equation (1) would be a relevant research question as well. Big customers apply a tender bidding system to make contracts, which highlights the need for investment analysis. However, quite often there are requirements for new machines in the commission requirement description, which narrows the potential of the entrepreneur in making a genuine investment decision.

It may be very interesting to find out for how long enterprises with poor profitability can survive and what the crucial reason to wind up an enterprise is. The bankruptcy statistics describe harvesting enterprises as their own class, but a problem arises with the one to two years' duration of the bankruptcy process when the adjudication process is taken into account. Using the bankruptcy statistics is also problematic in describing the economic situation in just the harvesting business because many smaller enterprises do not end in bankruptcy. The owner of the machine usually reclaims it and the entrepreneur is out of work, possibly still carrying debt consisting of the remaining part of the original loan. One other example of the difficulty in the use of the bankruptcy statistics in today's economic studies is that they do not yet show the results of the latest economic recession. During the period from 2003 to 2009, the number of bankruptcies was greatest at the beginning of 2003 (23) and second largest at the end of 2009 (19) (Konkurssit toimialoittain ... 2011). Between these points of time, the number of bankruptcies was less than 15 enterprises. In the year of the lowest harvesting volumes, 2009, the number of workers in bankrupt enterprises was clearly the highest during the period (65 persons). This shows that larger enterprises than before have collapsed. The indeterminate picture of bankruptcies suggests a failure study of the sector.

Literature

Alajoutsijärvi, K. Tikkanen, H. & Skaates, M.A. (2001). David against Goliath: Coping with adversial customers. A three-fold relational strategy for SMEs. The Journal of Selling & Major Account Management 3: 4, 33–51.

Aloittaneet ja lopettaneet yritykset (2011). ISSN=1797-0660. Helsinki: Tilastokeskus [Database only in Finnish. Free translation: The number of initiated and wound upand enterprises]. Available 1.2.2011: http://tilastokeskus.fi/til/aly/index.html.

Astrachan, J. H. & McConaughy, D. L. (2001). Venture capitalists and closely held IPOs: Lessons for family-controlled firms. Family Business Review 14: 4, 295–311

Audy, J.-F., D'Amours, S. & Rönnqvist, M. (2007). Business models for collaborative planning in transportation: An application to wood products. In: Camarinha_Matos, L. M., Afsarmanesh, H., Novais, P. & Analide, C. (eds.). Establishing the Foundation of Collaborative Networks, Springer, Boston, 667–676.

Aho, T. (1980). Empirical classification of financial ratios. In: Carlsson, C. (ed.) Management Science in Finland (MASC 1980), Proceedings, Turku, Finland, 413–421.

Ali, H. F. & Charbaji, A. (1994). Applying factor analysis to financial ration of international commercial airlines. International Journal of Commerce and Management 4: 1&2, 25–37.

Amigoni, F. (1978). Planning management control systems. Journal of Business Finance & Accounting 5: 3, 279–291.

Banker, R. D., Chang, H.-H. & Majumdar, S. K. (1993). Analysing the underlying dimension of firm profitability. Managerial and Decision Economics 14: 1, 25–36.

Barnes, P. (1987). The analysis and use of financial ratios: A review article. Journal of Business Finance & Accounting 14: 4, 449–461.

Baylton, R., Woods, A., & Zafiris. N. (1984). A note on the 'pyramid' technique of financial ratio analysis of the firms. Journal of Business Finance & Accounting 11: 1, 99–106.

Belkaoui, A. (1978). Financial ratios as predictors of Canadian takeovers. Journal of Business Finance & Accounting 5: 1, 93–107.

Bird, R. G. & McHugh, A. J. (1977). Financial ratios – an empirical study. Journal of Business Finance & Accounting 4: 1, 29–45.

Brozik, D. (1984). Profit Productivity: An Operational Productivity Measure for Financial Institutions. University of South Carolina, Dissertation, University Microfilms International. 272 pp.

Castro, N. R. & Chousa, J. P. (2006). An integrated framework for the financial analysis of sustainability. Business Strategy and Environment 15: 5, 322–333.

CCA. (2000). A guide to the analysis of financial statements of Finnish companies. Committee for Corporate Analysi, Gaudeamus, Helsinki, 85 pp.

CCA. (2005). Yritystutkimuksen tilinpäätösanalyysi [The financial statement analysis of enterprise research]. Yritystutkimusneuvottelukunta [Committee for Corporate Analysis]. Gaudeamus, Helsinki, 110 pp. [In Finnish] ISBN 951-662-962-8.

Chan J. W., Tam, C. M. & Cheung, R. (2005). Monitoring financial health of contractors at the aftermath of the Asian economic turmoil: A case study in Hong Kong. Construction Management and Economics 23: 5, 451–458.

Choi, F. D. S., Hing, H., Min, S. K., Nam, S. O. Ujie, J, & Stonehill. A. (1983). Analysing foreign financial statements: The use and misuse of international ratio analysis. Journal of International Business Studies 14:1, 113–131.

Courtis, J. K. (1978). Modelling a financial ratios categoric framework. Journal of Business Finance & Accounting 5: 4, 371–386.

Courtis, J. K. (1996). Annual report financial ratio component consistency. Asian Review of Accounting 4: 1, 146–162.

Cote, J. M. & Latham, C. K. (1999). The merchandising ratio: A comprehensive measure of working capital strategy. Issues in Accounting Education 14: 2, 255–267.

Cowen, S. S. & Hoffer, J. A. (1982). Usefulness of financial ratios in a single industry. Journal of Business Research 10: 1, 103–118.

Dale, Ø. (1993). Driftsökonomi og arbeidsmiljö blant norske skogsmaskinentreprenörer. Summary: Business economics and work environment among Norwegian forest contractors. Rapport fra Skogforsk 25. 44 pp. [In Norwegian]

Dehning, B. & Stratopoulos, T. (2002). DuPont analysis of an IT-enabled competitive advantage. International Journal of Accounting Information Systems 3: 3, 165–176.

Drury, J. C. (1981). A study of industry financial ratios. Management Decision 19: 1, 24–35.

Earl, P. (1983). The Economic Imagination: Towards a behavioural analysis of choice. Wheatsheaf Books, Brighton. xi + 206 pp.

Fadel, H. & Parkinson, J. M. (1978). Liquidity evaluation by means of ratio analysis. Accounting and Business Research 30, 101–107.

Fama, E. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. Journal of Finance 25: 2, 383–417.

Fama, E. & French, K. (2002). Testing Trade off and Pecking Order Predictions about Dividends and Debt. Review of Financial Studies 15: 1, 1–37,

Finnish Statistical Yearbook of Forestry 2010, 2010. Finnish Forest Research Institute, Helsinki. 472 pp.

Forest Industries. 2011. Accessed February 2, 2011. Available at: http:www.forestindustries.fi/tietopalvelu/Pages/default.aspx

Guam, L., Kaminski, K. A. & Wetzer, T. S. (2001). Ratio analysis - predictor of fraud. Oklahoma State University, Oklahoma, USA. 22 pp. Available 1.3.2011: http://aaahq.org/audit/midyear/01midyear/papers/kaminski.pdf

Hakkila, P., Mäkinen, P. & Kanninen, K. (1989). Metsäkoneurakoitsija. [The forest machine entrepreneur] Koneurakoitsijain liitto [The Association of Machine Contractors]. 93 pp. [In Finnish]

Hall, G. C., Hutchinson, P. J., Michaelas, N. (2004). Determinants of the capital structures of European SMEs. Journal of Business Finance & Accounting 31: 5/6, 711–728.

Hannus, J. (2004). Stategisen menestyksen avaimet. Tehokkaat strategiat, kyvykkyyden ja toimintamallit [Keys of strategic success: Effective stategies, competencies and action models]. ProTalent, Espoo, Finland. 397 pp. [In Finnish]

Heikkilä, J. & Sirén, M. (2006). Energiapuuharvennus kannattaa osasssa nuoria kasvatusmetsiä. Summary: Energy wood thinning is often profitable for the forest owner. Työtehoseuran metsätiedote [Forestry Bulletin] 695, TTS Institute (Work Efficiency Institute), Box 28, FI-0211 Helsinki, Finland, 4 pp.

Heyman, D., Deloof, M. & Ooghe, H. (2008). The financial structure of private held Belgian Firms. Small Business Economics 30: 3, 301–313.

Hopwood, W. (2003). Market effects, size contingency and financial ratios. Review of Accounting & Finance 2: 1, 3–9.

Horrigan, J. O. (1965). Some empirical bases of financial ratio analysis. The Accounting Review 43: 3, 558–568.

Horrigan, J. O. (1968). A short history of financial ratio analysis. The Accounting Review 43: 2, 284–294.

Horrigan, J. O. (1983). Methodological implications of non-normally distributed financial ratios: A comment. Journal of Business Finance & Accounting 10: 4, 638–689.

Houghton, K. A. & Woodliff, D. R. (1987). Financial ratios: The prediction of corporate 'success' and failure. Journal of Business Finance & Accounting 14: 4, 537–554.

Högnäs, T. (2000). Towards supplier partnership in timber harvesting and transportation. Forestry Publications of Metsähallitus [State Forest and Park Services] 37, Finland. 45 pp.

James, H. B. (1923). Financial and operating ratios in management. The Roland Press Company, New York, xii + 396 pp.

Johnson, B. (1979). The cross-sectional stability of financial ratio patterns. Journal of Financial and Quantitative Analysis 14: 5, 1035–1049.

Johnson, H. T. & Kaplan, R. S. (1987). Relevance Lost: The Rise and Fall of Management Accounting. Boston, Massachusetts: Harvard Business School Press, 269 pp., ISBN 0-87584-138-4.

Kaiser, H. F. (1958). The varimax criterion for analytic rotation in factor analysis. Psychometrica 23: 3, 187–200. Available 4.6.2010: http://www.springerlink.com/content/977786th55m62671/fulltext.pdf.

Kakoyi, N. (2010). Koneyritysten tulokset 2009: Energiapuuun korjuun kannattavuus huolestuttava. [Results of machine enterprises 2009: The profitability of energy wood-harvesting is alarming]. Koneyrittäjä 4, 28–29. [In Finnish]

Kallunki, J. P. & Kytönen, E. (2007). Uusi tilinpäätösanalyysi [Recent analysis of financial statements]. Talentum, Helsinki 272 pp. [In Finnish]
Kakoyi, N. (2010). Koneyritysten tulokset 2009 - Energiapuuun korjuun kannattavuus huolestuttava. [Results of machine enterprises 2009: The profitability of energy wood harvesting is alarming]. Koneyrittäjä 4, 28–29. [In Finnish]

Kanto, A. & Martikainen, T. (1991. A confirmatory test of an a priori classification pattern of financial ratios: Empirical evidence with U.S. data. The Finnish Journal of Business Economics 40: 1, 22–38.

Konkurssit toimitaloittain (TOL 2008), (2011). [In Finnish, Free translation in English: Bankcruptcies by line of activity] Statistics Finland. Available 31.1. 2011. http://pxweb2.stat.fi/Dialog/varval.asp?ma=020_konk_tau_102_fi&ti=Konkurssit+toimialoittain+%28TOL+2008%29&path=../Database/StatFin/oik/konk/&lang=3&multilang=fi

Kuh, E. & Meyer, J. R. (1955). Correlation and regression estimates when the data are ratios. Econometrica 23: 4, 400–416.

Laitinen, E. K. (1991). Financial ratios and different failure processes. Journal of Business Finance & Accounting 18: 5, 649–673.

Laitinen, E. K. (2000). Long-term success of adaptation strategies: Evidence from Finnish Companies. Long Range Planning 33: 6, 805–830.

Laitinen, E. K. (2002). Strateginen tilinpäätösanalyysi: Perinteisestä analyysistä yrityksen arvon määrittämiseen [Strategic analysis of the closing of the books: From traditional analysis to the value determination of an enterprise]. Kaup-pakaari, Helsinki 234 pp. [In Finnish]

Laitinen, E. K. (2006). Financial statement analysis of a network of SMEs: To-wards measurement of network performance. International Journal of Networking and Virtual Organisations 3: 3, 258–279.

Laitinen, E. K: & Laitinen, T. (2004). Yrityksen rahoituskriisin ennustaminen [Prediction of the financial crisis of an enterprise]. Talentum, Helsinki, 405 pp. [In Finnish]

Laurent, C. R. (1979). Improving the efficiency and effectiveness of financial ratio analysis. Journal of Business Finance & Accounting 6: 3, 401–413.

Lev, B. (1974). Financial Statement Analysis: A New Approach. Englewood Cliffs, New Jersey: Prentice Hall, Inc. 262 pp.

Lev, B. & Sunder, S. (1979). Methodological issues in the use of financial ratios. Journal of Accounting and Economics 1: 3, 187–210.

Martikainen, T. (1992). Time series distrbutiona properties of financial ratios: Empirical evidence from Finnish listed firms. European Journal of Operational Research 58: 3, 344–355.

Martikainen, T., Perttunen, J., Yli-Olli, P. & Gunasekaran, A. (1995). Financial ratio distribution irregularities: Implications for ratio classification. European Journal of Operational Research 80: 1, 34–44.

Matilainen, J. (2007). Alueurakoinnnin vaikutus puunhankinnan kustannustehokkuuteen [The impact of areal entrepreneursip on the cost-effectiveness of timber harvesting], University of Joensuu, Faculty of Forest Sciences, Masters thesis, 57 pp. [In Finnish]

McLeay, S. & Trigueiros, D. (2002). Proportionate growth and the theoretical foundations of financial ratios. ABACUS 38: 3, 297–316.

McMahon, R. G. P. & Davies, L. G. (1994). Financial reporting and analysis practices in small enterprises: Their association with growth rate and financial performance. Journal of Small Business Management 32: 1, 9–17.

Metinfo Forest statistics (2010). Finnish Forest Research Insititute. Available 10.1.2011: http://www.metla.fi/metinfo/index-en.htm.

Metsäalan konekustannusindeksi 2010 - Kostnadsindex för skogsmaskiner 2010, [Forest machine cost index 2010]. (2010). Statistics Finland. Liable to charge. Supplied monthly as an 8-page MS Excel sheet. Available 7.6.2010: http://tilastokeskus.fi/til/mekki/index_en.html.

Metsäteho Oy. (2011). Available 11.3.2011: http://www.metsateho.fi/aboutus/presentation/.

Michaelas, N., Chittenden, F. & Poutziouris, P. (1999). Financial policy and capital structure choice in U.K. SMEs: Empirical evidence from company panel data. Small Business Economics 12: 2, 113–130.

Ministry of Employment and the Economy (2009). Toimialaraportit [Industry reports]. The Ministry of Employment and the Economy [In Finnish]. Available 4.6.2010: http://www.temtoimialapalvelu.fi/index.phtml?s=5.

Modigliani F. & Miller M. (1958). The cost of capital, corporation finance and the theory of investment. The American Economic Review 48: 3, 261–296.

Myers, S. C. & N. Majluf, N. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics 13: 29, 187–221.

Mäkinen, P. (1988). Metsäkoneurakoitsija yrittäjänä. Summary: The forest machine contractor as an entrepreneur. Finnish Forest Research Institute, Helsinki, Folia Forestalia 717, 37 pp .

Mäkinen, P. (1993). Metsäkoneyrittämisen menestystekijät. Summary: Success factors for forest machine contractors. Folia Forestalia 818. 23 pp.

Mäkinen, P. (1996). Metsäkoneyrittämisen maailma [The world of forest machine entrepreneurship]. In: Puoli vuosisataa koneellista puunkorjuuta [A half decenni-

um of mechanical wood harvesting]. 8-15 pp. Gummeruksen Kirjapaino Oy, Jyväskylä, 190 pp. [In Finnish] ISBN 952-90-7236-8.

Mäntynen, N. (2009). Kausiluonteisen puunkorjuu-urakoinnin kannattavuus [The profitability of the seasonal harvest contracting]. University of Helsinki, Department of Forest Economics, Master's thesis, 74 pp. [In Finnish]

von Neumann, J. & Morgenstern. (1944). Theory of Games and Economic Behavior. Princeton University Press, Princeton, xviii + 625 pp.

Norin, K. & Thorsen, Å. (1998). Skogbrukets ”bästa” entreprenadföretag - deras starka sidor och vad de vill förbättra. Summary: The top logging contractors - their strangths and aims. Skogforsk Resultat 9. 4 pp. [In Swedish]

Palepu, K. G., Healy, P. M., Berhard, V. L. & Peek, E. (2007). Business Analysis and Valuation: IFRS Edition Texts and Cases. Cengage Learning: Florence, KY, USA, xvi + 788 pp.

Patton, J. M. (1982). Ratio analysis and efficient markets in introductory financial accounting. The Accounting Review 57: 3, 627–630.

Pekka, L. (2008). Var tredje skogsentreprenör gjorde förlust! [Every third entrepreneur made a loss]. Tidningen Skosgsteknik [Forest Technology Newspaper] 1, 34–35. [In Swedish]

Penttinen, M., Mikkola, J. & Rummukainen, A. (2009a). Profitability of wood harvesting enterprises. Working Papers of the Finnish Forest Research Institute 126. 39 pp. Available 4.6.2010: http://www.metla.fi/julkaisut/workingpapers/2009/mwp126.htm.

Penttinen, M., Rummukainen, A. & Mikkola, J. (2011). Profitability, liquidity and solvency of wood harvesting contractors in Finland. Small-scale Forestry 10(2): 211-239.

Penttinen, M., Rummukainen, A., Leppänen, J. Mikkola, J. (2009b). Kuinka paljon koneyrittäjiä oikein on? [How many forest machine entrepreneurs there are?] Koneyrittäjä [Machine entrepreneur]1: 14–15. [In Finnish] Available 10.3.2011: http://www.metla.fi/hanke/3454/metsakoneyrittajat.pdf.

Pinches, G. E., Mingo, K. A. & Caruthers, J. K. (1973). The stability of financial patterns in industrial organizations. Journal of Finance 28: 2, 389–396.

Pinches, G., Eubank, A, Mingo, K. & Caruthers, J. K. (1975). The hierarchical classification of financial ratios. Journal of Business Research 3: 4, 295–310.

Rajamäki, J. & Heikka, T. (1990). Metsäkoneyrityksen koko ja muut kannattavuuteen vaikuttavat seikat [The size of the forest machine enterprise and other factors affecting profitability]. Metsäteho Review 15, 6 pp. [In Finnish]

Rekilä, M. & Räsänen, T. (2008). Laajavastuinen yrittäjyys puunhankinnassa [Broad responsibility entrepreneurship in timber harvesting]. Metsätehon Katsaus 33 [Forest Effectiveness Review 33] 4 pp. [In Finnish] Available 4.6.2010: http://www.metsateho.fi/files/metsateho/Katsaus/Katsaus_033.pdf.

Robertson, J. (1983). Company failure. Measuring changes in financial health through ratio analysis. Management Accounting 61: 10, 24–28.

Robertson, J. (1984). Research directions in financial ratio analysis. Management Accounting 63: 8, 30–31.

Rummukainen, A., Brogt, T. & Kastenholz, E. (2006). Challenges for forestry contractors: Various structures but mutual problems in Finland, Germany, Poland and Romania. In: Niskanen, A. (ed.). Issues affecting enterprise development in the forest sector in Europe. University of Joensuu, Faculty of Forestry, Research Notes 169: 149-174. Available 4.6.2010: http://joypub.joensuu.fi/publications/other_publications/niskanen_issues/index_en.html.

Rumpunen, H. (1996). Kilpailulaki kaatoi keskitetyn taksasopimusjärjestelmän. [The competition law brought down the central tariff agreement system] In: Puoli vuosisataa koneellista puunkorjuuta [A half decennium of mechanical wood harvesting]. Gummerus Kirjapaino Oy, Jyväskylä: 168–172. [In Finnish]

Sabri, N. R. (1998). Financial analysis of Palestinian industry including small scale firms. Small Business Economics 11: 3, 293–311.

Salmi I. (2006). Mitä tilinpäätös kertoo [What does a closing of the accounts tell?] 4. Renewed edition. Edita, Helsinki, 274 pp. ISBN 951-375734-X [In Finnish].

Salmi, T. & Martikainen, T. (1994). A review of the theoretical and empirical basis of financial ratio analysis. The Finnish Journal of Business Economics 43: 4, 426–448. Available 4.6.2010: http://lipas.uwasa.fi/~ts/ejre/ejre.html.

Salmi, T., Virtanen, I. & Yli-Olli, P. (1990). On the classification of financial ratios: A factor and transformation analysis of accrual, cash flow and market-based ratios. Acta Wasaensia 25, University of Vaasa, Vaasa, 33 pp. Available 4.6.2010: http://lipas.uwasa.fi/~ts/sera/sera.html.

Saviaho, A. (2009). Liikevaihdon voimakas kasvu siirtyi vain osittain katteisiin [The strong growth of turnover only partly surpassed margins]. Koneyrittäjä [Machine Entrepeneur] 1, 10–12. [In Finnish]

Serrasqueiro, Z.. S. & Nunes, P. M. (2008). Performance and size: Empirical evidence from Portuguese SMEs. Small Business Economics 31: 2, 195–217.

Shlens, J. (2009). A Tutorial on Principal Component Analysis. New York University, NY. Available 4.6.2010: http://www.snl.salk.edu/~shlens/pca.pdf.

Slater, S. T. & Olson, E. M. (1996). A value-based management system. Business Horizons 39: 5, 48–52.

Sogorb-Mira, F. (2005). How SME uniqueness affects capital structure: Evidence from a 1994-1998 Spanish panel data. Small Business Economics 25: 5, 447–457.

Soirinsuo, J. & Makinen, P. (2009a). Importance of the financial situation for the growth of a forest machine entrepreneur. Scandinavian Journal of Forest Research 24, 3, 264–272.

Soirinsuo, J. & Mäkinen, P. (2009b). Kannattavan kasvun avaimet metsäkonealalla [Keys of profitable growth in the forest machine business]. TTS tutkimuksen tiedote [Bulletin of the TTS (Work Efficiency Institute) bulletin, Luonnonvara-ala: Metsä [Natural resources: Forest] 727, 1 –4. [In Finnish]

Soirinsuo, J. & Mäkinen, P. (2010). Kannattava kasvu ei ole päämäärätöntä [Profitable growth is not direction]. TTS tutkimuksen tiedote, Luonnonvara-ala: Metsä [Forestry Bulletin] 738, TTS Insitute (Work efficiency Insitute), Box 5, FI 05201 Rajamäki, Finland, 4 pp.

Solmio, H. and Alanen, V.-M. (2008). Lämpöyrittäjätoiminta vuonna 2007. Summary: Heating entrepreneur activity in 2007. TTS Research (Work Efficiency Institute), Forestry Bulletin Series 725, 1–4.

Stapleton, D., Hanna, J. B., Yagla, S., Johnson, J. and Markussen, D. (2002). Measuring logistic performance using the strategic profit model. International Journal of Logistics Management 13: 1, 89–107.

Statistics Finland. (2009). Statistics are liable to charge. Available 10.3.2010: http://tilastokeskus.fi/til/patipa/index_en.html

Stora Enso. (2007). Stora Enso Oyj Pörssitiedote 29.3.2007 [Stora Enso Ltd. Stock exchange notice]. 1 p. [In Finnish] Available 4.6.2010: http://porssi.talouselama.fi/listsmall.aspx?list=pressdetail&tabname=pressdetailtab&id= HUG2007032900110604

The Trade Association of Finnish Forestry and Earth Moving Contractors. (2011). Available 10.3.2011: http://www.koneyrittajat.fi/?id=103

Thomas, J. III & Evanson, R. V. (1987). An empirical investigation of association between financial ratio use and small business success. Journal of Business Finance & Accounting 14: 4, 555–571.

Tike (2010). Statistics Finland, 2009. Statistics are liable to charge. Available 2.8.2010: http://tilastokeskus.fi/til/maa_en.html

TraFi (2010). Finnish Transport Safety Agency. Liable to charge statistics are published only in Finnish. Available 2.8.2010: http://www.ake.fi/AKE_EN/Statistics/

Trigueiros, D. (1995). Accounting identities and the distribution of ratios. British Accounting Rewiew 27: 2, 109–126.

Turkulainen, P. (2008). Puunkorjuuyritysten liikevaihto jälleen hyvässä kasvussa. [Wood harvesting enterprise turnover is again showing good growth]. Koneyrittäjä 2, 18–20. [In Finnish]

Turkulainen, P. (2009). Maanrakennusalan yritykset jatkoivat vielä kasvuaan [Enterprises in the earth construction business still continued to grow]. Koneyrittäjä 2, 14–16.

Uusitalo, J. and Markkola, J.-M. (2006). Entrepreneurship in forestry – is it worth activating? Forestry Studies 45, 67–73. Available 4.6.2010: http://mivana.emu.ee/orb.aw/class=file/action=preview/id=261970/Mets_45_08_Uusitalo_Markkola.pdf.

Väkevä, J. & Imponen, V. (2001). Puutavaran korjuu- ja kuljetusyritysten kannattavuus vuosina 1995-2000. [Profitability of wood harvesting and transport enterprises in 1995-2000]. Metsäteho report 125. 67 pp. [In Finnish]. Available 4.6.2010: www.metsateho.fi/uploads/kvv86.pdf

de Wet, J. H. v. H. & du Toit, E. (2007). Return on equity: A popular, but flawed measure of corporate financial performance. South African Journal of Business Management 38: 1, 59–69

Wood products industry. (2010). Toimialaraportit [Industry reports]. Puutuoteteollisuus [Wood products industry]. Finnish Ministry of Employment and the Economy. [In Finnish] Available 4.6.2010: http://www.temtoimialapalvelu.fi/index.phtml?s=8.

Yang, Z. & Mohammed, A. (2008). Business model design for capacity-driven services from high altitude platforms. 3rd IEEE/IFIP International Workshop on Business-driven IT Management, BDIM 2008. Article number 4540086, 118–119.

Yli-Olli, P. & Virtanen, I. (1985). Modelling a financial ratio system on the economy-wide level. Acta Wasaensia 21, University of Vaasa, Vaasa, Finland, 74 pp.