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Management of liquidity and liquid assets in small and medium-sized enterprises

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ABSTRACT

Management of liquidity and liquid assets focuses on cash inflows and outflows along with a trade-off between liquidity versus investment of surplus cash in order to improve profitability. Firstly, the purpose of the empirical part of the study is to analyse liquidity of small and medium-sized enterprises (S.M.E.s) and, secondly, to explore the dependence between liquidity and profitability. Thirdly, the aim of the theoretical research is to explore liquidity and liquid assets as well as their determinants. In this part we focus on developing a new mathematical model for calculating net earnings through decreasing the amount of liquid assets. With this model, S.M.E.s can consider net earnings in managing and decreasing liquid assets in order to improve profitability.

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1. Introduction

Liquidity is an important factor in determining short-term financial management policies and it is more of a tactical concept related to the small and medium-sized enterprises (S.M.E.)'s ability to pay for its current obligations when they fall due at minimal cost. Literature has demonstrated that there exists a trade-off between liquidity and profitability which discourages enterprises from having excessive liquidity.

Our studies have analysed the dependence between liquidity level measured by cash to current liabilities ratio and profitability of surveyed enterprises. We hypothesise that there may be a negative correlation among them coupled with the fact that a decrease in liquid assets triggers an increase of profitability expressed in terms of return on assets. We expect that our findings support the notion that a trade-off exists between the liquidity position and profitability.

Research has been carried out which studied and improved some aspects of management of liquidity. However, the financial ramifications from a revision of liquidity policy, which have important implications for efficient management of cash and liquidity, have not been explored entirely in previous studies. With the aim of completing the gaps relating to the financial impact from changing the liquidity policy of

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S.M.E.s, the study will explore the ensuing benefits from changing the liquidity policy as well as net profitability through decreasing the amount of liquid assets and investing surplus cash or reducing their sources of financing.

The aim of this paper is to contribute to the debate by empirically investigating the S.M.E.s' level of liquidity as well as the relationship between level of liquidity and profitability, and by modelling in order to develop a new mathematical model for estimating the financial effects of changing the liquidity policy of S.M.E.s. This paper addresses how an S.M.E.'s liquidity position affects profitability.

The purpose of this study is to describe and explore re-evaluation of the liquidity policy of S.M.E.s in order to decrease liquid assets and invest surplus cash, or to reduce costs of financing as well as to improve profitability at an acceptable level of liquidity risk. The outcome represents new models for calculating net savings through decreasing the amount of liquid assets and investing surplus or through reducing their sources of financing, and with these models an S.M.E. can consider net profitability from carrying out these activities.

The remainder of the paper is organised as follows. [Section 2](#) addresses the theoretical grounds of the research. [Section 3](#) explains the methodology, presents a descriptive analysis of the data as well as results, and provides a discussion. [Section 4](#) addresses theoretical grounds for modelling and develops corresponding models. Finally, [Section 5](#) is the conclusion.

2. Literature review

Liquidity is a function of current assets and current liabilities and their composition. A company's level of liquidity depends upon the amount of the company's cash, the amount of other assets that can be quickly converted to cash, whether the company is making or losing money, the amount of obligations that will require repayment in the near future and the ability of the company to raise more cash by issuing securities or borrowing money (Chambers & Lacey, 2011, p. 489).

The first essential ingredient of liquidity is the time it takes to convert an asset into cash or to pay a current liability and the quicker that an asset can be converted into cash, the more liquid it is. A second ingredient of liquidity is amount and an enterprise must have enough liquid resources to cover its financial liabilities coming due. Cost is the third ingredient and an asset is liquid if it can be quickly converted into cash with little cost. An enterprise is considered to be liquid if it has enough financial resources to cover its financial liabilities in a timely manner with minimal cost (Maness & Zietlow, 2005, p. 31).

Liquidity refers to an enterprise's ability to meet its current liabilities and is closely related to the size and composition of the enterprise's working capital position. Other things being equal, a higher working capital position implies a more liquid position. This is because the firm's current assets are the easiest to convert into cash, making them the main source of cash to meet maturing liabilities (Shapiro, 1990, p. 734).

According to Helfert (1997), a liquid asset is an asset that can be rapidly converted into cash without suffering a significant reduction in value. A perfectly liquid asset is one that would entail no illiquidity discount (Bodie & Kane, 2009, p. 305). The liquid current assets are cash, marketable securities, accounts receivable and inventory.

Some marketable securities mature very soon, and can be converted quickly into cash at prices close to their book values. These securities are called cash equivalents and are included with cash. Other types of marketable securities have a longer time, until maturity, and their market values are less predictable. These securities are classified as short-term investments (Brigham & Ehrhardt, 2008, p. 86).

Accounts receivable, which arise from the sale of the enterprise's goods or services, are less liquid than marketable securities while inventory is often less liquid than accounts receivable. A liquid asset can be converted to cash quickly without having to reduce the asset's price very much (Brighman & Houston, 2004, p. 77). Campbell, Johnson and Savoie found that the traditional monitoring of accounts receivable and inventory, as well as short-term cash flow projections and good bank relationships, are viewed as extremely valuable tools in the management and planning of enterprise's liquidity (Maness & Zietlow, 2005, p. 32).

The goal of cash and liquidity management is to plan an enterprise's cash position so that cash is available when it is needed and all available idle cash is invested to provide maximum income. To ensure that all available funds are optimally invested, some enterprises maintain a zero balance in their bank accounts and fully invest all cash in government securities or money market funds (Engler, 1993, p. 409).

Two major aspects of liquidity are ongoing and protective liquidity. Ongoing liquidity refers to the inflows and outflows of cash through the enterprise as the product acquisition, production, sales, payment and collection process takes place over time. Protective liquidity refers to the ability to adjust rapidly to unforeseen cash demands and to have backup means available to raise cash (Pinches, 1994, p. 638).

The ongoing liquidity is influenced by all aspects of the cash cycle, because increases in purchases, inventory or receivables will decrease liquidity. As the cash conversion cycle lengthens, the enterprise's ongoing liquidity worsens, as the cycle is shortened, the enterprise's ongoing liquidity improves (Pinches, 1994, p. 639).

Ebben and Johnson (2011) investigated the relationship between cash conversion cycle and levels of liquidity, invested capital and performance in small firms over time. In a sample of 879 small manufacturing firms and 833 small retail firms, cash conversion cycle was found to be significantly related to all three of these aspects. Firms with more efficient cash conversion cycles were more liquid, required less debt and equity financing and had higher returns.

Protective liquidity is the ability to have liquid resources to meet unexpected cash demands. According to Pinches (1994), planning the enterprise's short-term financial management policies and liquidity needs involves uncertainty and effective managers always maintain some protective liquidity. Effective short-term financial management involves a continual trade-off between risk and return. To deal with the risk of running short on cash at a crucial point in time, enterprises establish various means of ensuring protective liquidity. This may be in the form of lines of credit which are short-term borrowing agreements the enterprise has negotiated with a bank.

Campello, Giambona, Graham, and Harvey (2012) explored how enterprises in Europe used credit lines during the financial crisis. They found that firms with restricted access to credit draw more funds from their credit lines during the crisis than their large and profitable counterparts. Their findings suggest that credit lines

did not dry up during the crisis and provided the liquidity that firms used to cope with the exceptional contraction. Campello, Giambona, Graham, and Harvey (2011) also studied how enterprises managed liquidity during the 2008–2009 financial crisis. Their analysis provides new insights on interactions between internal liquidity, external funds and real corporate decisions such as investment and employment. They show how companies substitute between credit lines and internal liquidity (cash and profits) when facing a severe credit shortage. They find that credit lines are associated with greater spending when companies are not cash-strapped. Firms with limited access to credit lines appear to choose between saving and investing during the crisis. Their evidence indicates that credit lines eased the impact of the financial crisis on corporate spending.

Almeida, Campello, and Hackbarth (2011) studied the interplay between corporate liquidity and asset reallocation. Their findings show that financially distressed firms are acquired by liquid firms in their industries even in the absence of operational synergies. These acquisitions of distressed firms by liquid industry firms are denoted liquidity mergers. Almeida et al. (2011) analyse firms' liquidity policies as a function of real asset reallocation, examining the trade-offs between cash and credit lines. Their findings show that firms are more likely to use credit lines in industries with more liquidity mergers.

Liquidity can be measured by using different ratios but overall liquidity ratios generally do not give an adequate picture of an enterprise's real liquidity, due to differences in the kinds of current assets and liabilities the enterprise holds and it is necessary to evaluate the activity or liquidity of specific current accounts. Various ratios exist to measure the activity or liquidity of receivables and inventory. The accounts receivable turnover ratio gives the number of times accounts receivable is collected during the year and the days sales outstanding determines the average number of days it takes to collect credit sales. The higher the accounts receivable turnover, the better since the enterprise is collecting quickly from customers and these funds can be invested. Inventory turnover can be found by dividing annual cost of goods sold by the average inventory while the days inventory determines the average number of days it takes to produce and sell the product (Pinches, 1994, p. 639).

According to Shapiro and Balbier (2000), an evaluation of the quality of an enterprise's receivable and inventory accounts is critical to any assessment of liquidity. If accounts receivable and inventory turn over quickly, the cash flow received can be invested for a return, thus increasing net income.

Costs and benefits for holding liquid assets have to be carefully weighed against the opportunity costs for holding more productive but less liquid assets. Optimal amount of liquidity is determined by a trade-offs between the low return earned on liquid assets and the benefit of minimising the need for external finance (Kim, Mauer, & Sherman, 1998, p. 335).

If a firm has a temporary cash surplus, it can invest it in short-term marketable securities (Ross & Westerfield, 2005, p. 769). Short-term investments are usually undertaken when the firm has an excess of cash and can invest it in order to receive a higher return since having idle cash is considered inefficient.

Literature reports demonstrated that there is a trade-off between liquidity and profitability. Garcia-Teruel and Martinez-Solano (2007) examined the impact of

working capital management on the profitability of a sample of small and medium-sized Spanish enterprises. They have found a significant negative relation between an S.M.E.'s profitability and the number of days accounts receivable and days of inventory. The results also indicate that managers can create value by reducing their cash conversion cycle to a minimum. Equally, shortening the cash conversion cycle also improves the firm's profitability.

Czarnitzki and Hottenrott (2011) examined the relation between working capital level and profitability of S.M.E.s in Germany. They have shown that there is a non-monotonic (concave) relationship between working capital level and profitability of S.M.E.s, which implies that S.M.E.s have an optimal level of working capital that maximises their profitability.

Nunes, Viveiros, and Serrasqueiro (2011) examined the determinants of young Portuguese S.M.E. profitability: their findings suggest that age, size, liquidity and long-term debt are of greater relative importance for the increased profitability, while risk is of greater relative importance for the diminished profitability of young S.M.E.s, compared to the case of old S.M.E.s.

In contrast to previous findings, Banos-Caballero, Garcia-Teruel, and Martinez-Solano (2011) have found that there is an inverted U-shaped relationship between working capital level and profitability, which in turn indicates that both high and low working capital levels are associated with a lower profitability. Their results indicate that enterprises have an optimal level of working capital that balances costs and benefits and maximises their profitability; enterprises' profitability thus decreases as they move away from this optimal level.

Banos-Caballero, Garcia-Teruel, and Martinez-Solano (2014) examined the linkage between working capital management and corporate performance for a sample of non-financial British companies. The findings provide strong support for an inverted U-shaped relation between investment in working capital and firm performance, which implies the existence of an optimal level of investment in working capital that balances costs and benefits and maximises a firm's value.

Pais and Gama (2015) investigated the impact of working capital management on the profitability of small and medium-sized Portuguese firms. The empirical results indicate that a reduction in the inventories held and in the number of days that firms take to settle their commercial liabilities as well as to collect payments from their customers are associated to higher profitability. The relevance of quadratic dependences of the profitability on some variables was also identified and suggests a decreasing trend of return on assets with increasing values of the working capital management characteristic variables.

Lima, Martins, and Brandao (2015) investigated the impact of working capital management on profitability of S.M.E.s in European countries. The findings suggest that working capital management unequivocally affects profitability in European countries. The results also indicate that there is a positive relationship between liquidity and profitability. The positive relationship between liquidity and profitability can be explained by the fact that enterprises use first of all the amount of internally generated resources before seeking external resources, especially in the case of S.M.E.s, which have difficulties in obtaining external financing.

Lyngstadas and Berg (2016) examined the effect of working capital management on the profitability of small and medium-sized Norwegian firms. The empirical results indicate that reducing cash conversion cycle will increase profitability. The relevance of quadratic dependencies of the profitability on independent variables was also identified and suggests a decreasing trend of return on assets with increasing values of the working capital management characteristic variables. This study confirms that working capital management is relevant for firms' profitability.

Banos-Caballero, Garcia-Teruel, and Martinez-Solano (2016) investigated the relation between the financing strategies of working capital requirement and firm performance. Using the two-step generalised method of moments estimator, they find that a suitable financing strategy can help firms improve their performance. The findings are of interest for managers and researchers and show that managers should not only be concerned about investing in working capital requirement but also consider how this investment is to be financed.

Afrifa and Tingbani (2018) examined the relationship between working capital management and S.M.E.s' performance by taking into consideration the effect of cash flow. They applied panel data regression analysis on a sample of 802 British S.M.E.s for the period from 2004 to 2013. The results of the study demonstrate the importance of cash flow on S.M.E.s' working capital management and performance. According to their findings, working capital management has a significantly negative impact on S.M.E.s' performance. Their findings suggest that in an event of cash flow unavailability (availability) managers should strive to decrease (increase) the investment in working capital in order to improve performance.

Valaskova, Kliestik, and Kovacova (2018) investigated financial risks of Slovak companies. They focused on the revelation of significant economic risk factors using multiple regression. The empirical results suggest that the most significant predictors are net return on capital, cash ratio, quick ratio, current ratio, net working capital, RE/TA ratio, current debt ratio, financial debt ratio and current assets turnover based on which the decision about the future company default can be made. These factors are significant enough to manage financial risks and to affect the profitability as well as prosperity of the company.

Zimon (2018) examined the impact of purchasing groups on the financial situation of enterprises. Empirical research was based on a sample of 60 Polish S.M.E.s covering the years 2013–2015. The analysis showed that the choice of an appropriate group purchasing organisation had a large impact on financial situation of companies. The empirical results suggest that functioning within purchasing groups allows maintenance of safe financial liquidity, apart from obtaining a low price of purchased goods and materials, and has a positive impact on the effectiveness of managing receivables and short-term liabilities. The action within the branch or multi-branch purchasing groups has a positive effect on liquidity, profitability and management efficiency.

Kontuš (2018) investigated whether there was a relation between liquidity level, expressed in terms of net working capital as well as the cash-to-current-liabilities ratio and profitability of S.M.E.s and large companies in the Republic of Croatia in 2014. The study has not in any case provided empirical evidence that liquidity is negatively related to profitability.

Maintaining a proper balance between liquidity and profitability is important to the overall financial health of a business and in this study we examine the impact of liquidity on profitability. We also show how through decreasing the amount of liquid assets an S.M.E. can improve profitability.

3. Research

3.1. Methodology

This paper presents results from an empirical research undertaken on a representative sample of Croatian S.M.E.s with the aim of exploring their liquidity along with the dependence between the S.M.E.s' level of liquidity and profitability. The dataset was provided by the Financial Agency (F.I.N.A.) for Croatian enterprises on a yearly basis.

Our initial sample comprises 150 enterprises included in the F.I.N.A. database. The enterprises in the sample meet the European Commission's definition of S.M.E.s. Although the precise definition of an S.M.E. has varied greatly in prior studies, there is an increasing tendency to rely on the European Commission's one. In line with this definition, we selected enterprises that met the following criteria: (1) fewer than 250 employees; (2) sales below 50,000,000 EUR; and/or (3) annual total assets below 43,000,000 EUR.

From the basic set of S.M.E.s, which comprises more than 106,000 enterprises in Croatia, an initial sample of 150 major enterprises is selected according to the asset value criterion. The sample is reasonably representative of Croatian enterprises, as they cover all sectors, other than finance and insurance, due to their distinct financial behaviour and specificity. We also excluded enterprises that belong to the governmental sector because of additional requirements that apply to this sector. Enterprises showing extreme or inconsistent figures in any of the variables were excluded from the sample. In addition, we discarded observations with missing values. In so doing, we ended with a final sample of 93 S.M.E.s from Croatia over the period 2010–2014. The following methods were used for research data analysis: descriptive statistics, correlation analysis and panel data regression.

A fixed-effects model, random-effects model and pooled regression model were used in panel data analysis. The Hausman test was performed to decide between a random effects regression and a fixed-effects regression. The Breusch–Pagan Lagrange multiplier was used to decide between a random effects regression and a simple ordinary least squares (O.L.S.) regression. The statistical data analysis was carried out using Stata software version 15.0.

In this section, we provide an overview of the variables that were used in our empirical analysis:

1. Cash level is measured as the ratio of cash to current assets.

$$\text{Cash to current assets ratio} = \text{cash}/\text{current assets}$$

2. Liquidity is measured as

- Cash ratio: the ratio of cash to current liabilities
- Quick ratio: the ratio of cash and accounts receivable to current liabilities
- Current ratio: the ratio of current assets to current liabilities.

3. Leverage is measured as the ratio of total debt to total assets.
4. Profitability is defined as return on total assets.

Return on assets is the relationship of annual after-tax earnings to total assets, used as a measure of the productivity of a company's assets (Helfert, 1997, p. 359). Using methods from statistics, we examined the trade-off between liquidity and profitability. We used financial ratios in order to improve the quality of analysis and descriptive statistics analysis.

In this study, we also analysed liquidity and liquid assets, as well as their determinants. The independent variables that determine net earnings through decreasing the amount of liquid assets and investing surplus cash or through reducing their sources of financing have been selected and the relations between them have been defined. For a precise formulation of the relationship between a set of independent variables, mathematical methods have been adapted to yield net earnings as a dependent variable. On the basis of our research results, we have introduced new models for calculating the net savings through decreasing the amount of liquid assets.

3.2. Results of empirical analysis and discussion

We separately analysed the dependence between cash level and liquidity, and the dependence between the liquidity and profitability of the examined enterprises.

3.2.1. Relation between cash level and liquidity of surveyed enterprises

As cash presents a certain standard of liquidity, we analysed the liquidity position of the examined enterprises along with the dependence between cash level and liquidity, as measured by different liquidity ratios. The level of cash expressed in terms of the ratio of cash to current assets and liquidity in surveyed S.M.E.s in the Republic of Croatia in 2014 is shown in Table 1.

The results of liquidity analysis, measured by liquidity ratios, indicate that the liquidity position of surveyed S.M.E.s is appropriate. As it is generally accepted that the quick ratio should be 1 or higher and an enterprise should have a current ratio greater than 2 in order to pay off current liabilities in time, it can be concluded that surveyed S.M.E.s can avoid financial difficulties regarding not-payment of due current liabilities.

The average value of cash to current assets ratio for surveyed S.M.E.s during the observed period is 0.11 with a standard deviation of 0.17 while the average value of cash to current liabilities ratio is 0.59 with a standard deviation of 0.32. For S.M.E.s, the correlation coefficient between the cash to current assets ratio and the liquidity

Table 1. Descriptive statistics for cash and liquidity ratios in Croatian surveyed SMEs in 2014.

Ratios	Arithmetic mean	Standard deviation	Coefficient of variation	Correlation coefficient
Cash/current assets ratio	0.11	0.17	154.55	–
Cash/current liabilities ratio	0.59	0.32	54.24	0.41
Quick ratio	1.47	2.75	187.07	0.39
Current ratio	2.15	3.95	183.72	0.32

Source: Authors' calculations.

Table 2. Correlation coefficients for liquidity and profitability ratios in Croatian surveyed SMEs over the period 2010–2014.

Correlation coefficient	2010.	2011.	2012.	2013.	2014.
Current assets to current liabilities ratio	−0.179	−0.154	−0.129	−0.131	−0.132
Return on assets					

Source: Authors' calculations.

expressed in terms of cash liquidity ratio is 0.41, which confirms that the correlation between them is positive and weak. In addition, our results indicate that the average value of quick ratio is 1.47 with a standard deviation of 2.75. Cash level is positively related to liquidity expressed in terms of quick ratio for S.M.E.s under review and the correlation between them is positive and weak. Repeating our analysis of liquidity expressed in terms of current ratio, we have found similar relation between cash level and liquidity.

We have found a weak positive dependence between cash level and liquidity expressed in terms of current ratio. The positive correlation between variables cash level and liquidity measured by different ratios is an indication that a change in the level of cash is associated with a consistent and equivalent change in the level of liquidity.

3.2.2. Relation between liquidity level and profitability

We next investigated whether there was a relationship between liquidity level, expressed in terms of the current-assets-to-current-liabilities ratio and profitability expressed in terms of return on assets, and analysed the dependence between them. Table 2 presents the correlation coefficients for liquidity and profitability ratios in surveyed enterprises over the period 2010–2014.

The correlation coefficients between the variables current-assets-to-current-liabilities ratio and the return on assets for S.M.E.s during the observed period have a negative sign, which indicates that the correlation between current-assets-to-current-liabilities ratio and return on assets is negative and weak. We have found a weak negative dependence between liquidity expressed in terms of current-assets-to-current-liabilities ratio and profitability expressed in terms of return on assets, indicating that as the values of current-assets-to-current-liabilities ratio increase, the values of the return on assets tend to decrease. We confirmed our hypothesis: there may be a negative correlation among liquidity and profitability with the fact that a decrease in liquid assets triggers an increase of profitability expressed in terms of return on assets.

We also examined the impact of liquidity on the profitability of Croatian S.M.E.s over the period 2010–2014. The leverage variable has been included in the regression in order to test whether and to what extent debt financing and interest expenses influence profitability. Table 3 presents the regression estimators by using random effects regression.

The Hausman test and Breusch–Pagan Lagrangian test show that the random effects model is preferable over O.L.S. and fixed-effects models.

We have found that liquidity and leverage ratios have an influence on the profitability of examined S.M.E.s. The regression results indicate that the return on assets variable of the examined enterprises decreases when the leverage variable increases. Debt ratio has a negative and significant impact on profitability of examined enterprises. We have found that liquidity measured by current ratio has a negative but not significant impact on profitability of examined enterprises over the period 2010–2014.

Table 3. Regression results with panel data - Random-effects G.L.S. regression.

Independent variable	Coefficient	Standard error	z	p-value	95% conf. interval	
Current ratio	-.0006512	.0006066	-1.07	0.283	-.00184	.0005376
Debt ratio	-.0561182	.017453	-3.22	0.001	-.090325	-.021911
Constant	.0175309	.0101342	1.73	0.084	-.002331	.037393

$R^2 = 0.2439$

Number of observations: 465

Dependent variable: Return on assets

F test: $F(88, 354) = 2.45$ Prob > F = 0.0000.

Hausman test: $\chi^2(3) = 5.58$ Prob > $\chi^2 = 0.1340$.

Breusch and Pagan Lagrangian test: $\text{chibar}^2(01) = 40.18$ Prob > $\text{chibar}^2 = 0.0000$.

White's test for heteroskedasticity: $\chi^2(5) = 5.15$ Prob > $\chi^2 = 0.498$.

Wooldridge test for autocorrelation: $F(1, 88) = 0.725$ Prob > F = 0.3970.

3.3. Discussion

Our results of liquidity analysis of surveyed enterprises indicate that the ability of S.M.E.s to meet their current liabilities from cash is acceptable and these enterprises have a certain margin of safety to retain their good financial health as well as avoid financial difficulties regarding not-payment of due current liabilities. We add that the correlations between cash level and the liquidity measured by different liquidity ratios all have the predictable sign. We confirm that during the observed period the correlation between cash level and liquidity for surveyed S.M.E.s is positive and an increase in the cash level triggers an increase of liquidity expressed in terms of liquidity ratios. Our results are also consistent with an existing theory of liquidity, as we observe a positive relationship between cash level and liquidity.

We have investigated whether there is a relationship between liquidity level, expressed in terms of current-assets-to-current-liabilities ratio and profitability, expressed in terms of return on assets. This study has provided empirical evidence of a negative relationship between S.M.E.s' level of liquidity expressed in terms of current-assets-to-current-liabilities ratio and return on assets. We confirm that during the observed period the correlation between liquidity expressed in terms of current-assets-to-current-liabilities ratio and return on assets for examined enterprises is negative and weak and an increase in the current-assets-to-current-liabilities ratio triggers a reduction of profitability. We can summarise that these findings support the notion that the liquidity position depends on cash. The study has provided empirical evidence that liquidity is negatively related to profitability and the findings support the notion that a trade-off exists between the liquidity position and profitability.

We have also found that liquidity measured by current-assets-to-current-liabilities ratio has a negative but not significant impact on profitability of examined enterprises. Finally, we can conclude that a high level of debt due to high interest payments and increased risk will decrease the profitability of S.M.E.s.

The main objective of a liquidity policy as part of a financial policy is to assure enough cash as well as quick conversion of other liquid assets into cash in order to maintain solvency as well as improve profitability. The policy of liquidity has a great impact on net income and profitability of S.M.E.s which can increase by minimising the costs of financing liquid assets or by maximising the return on excess liquid assets. Consequently, the policy of liquidity must aim to achieve and maintain an

optimal amount and structure of liquid assets which can be converted quickly into cash. The S.M.E. can re-evaluate its liquidity policy as well as investment policy.

Excessively high liquidity may mean that management has not aggressively searched for desirable capital investment opportunities. Maintaining a proper balance between liquidity and profitability is important to the overall financial health of a business and S.M.E.s. Effective liquidity management includes assuring adequate liquidity of S.M.E.s as well as decreasing the amount of liquid assets needed to support operations in order to invest surplus cash or to reduce costs of financing liquid assets thus increasing net income and profitability.

4. Models

Before changing its liquidity policy, an S.M.E. has to weigh the profit potential against the liquidity risk inherent in decreasing the amount of liquid assets for supporting operations. Aggressive liquid asset management increases receivables turnover and inventory turnover. An increasing receivables turnover is usually a positive sign, showing the S.M.E. is successfully executing its credit policies and quickly turning its accounts receivables into cash and an increase in receivables turnover (annual sales being equal) will decrease the average amount of receivables. An increasing inventory turnover is also a positive sign, showing the S.M.E. can quickly sell its inventories and an increase in inventory turnover (annual cost of goods sold being equal) will reduce the average amount of inventory. As lowering liquid assets can result in a reduction of their sources of financing and costs of financing as well as in excess amount of liquid assets for investment, it has a positive impact on profitability of S.M.E.s.

Using economic and mathematical principles, we have developed a new mathematical model for calculating net savings through lowering the amount of liquid assets. In developing this model, we have used the basic concept of comparing the benefits of changing the amount of liquid assets versus the costs of financing liquid assets. We have analysed benefits from increasing coefficients of turnover of liquid assets' units resulting in a drop in the amount of liquid assets and on the basis of research results we have developed a new model for calculating net savings from decreasing the amount of liquid assets required.

Net annual savings through decreasing liquid assets can be defined as

$$\text{net savings} = (\text{additional earnings} - \text{costs of financing}) \times \left(1 - \frac{\text{profit tax}}{100}\right) \quad (1)$$

Benefits from investing excess cash (decrease in liquid assets) can be defined

$$\text{additional earnings} = \text{decrease in liquid assets} \times \frac{\text{rate of return on investment}}{100} \quad (2)$$

Costs of financing excess cash (decrease in liquid assets) can be defined

$$\text{costs of financing} = \text{decrease in liquid assets} \times \frac{\text{interest rate}}{100} \quad (3)$$

Net annual savings through decreasing liquid assets and investing excess cash can be re-expressed as follows

net savings = decrease in liquid assets

$$\times \frac{(\text{rate of return on investment} - \text{interest rate})}{100} \times \left(1 - \frac{\text{profit tax}}{100}\right) \quad (4)$$

where

rate of return on investment – expressed as percentage

interest rate – expressed as percentage

profit tax – expressed as percentage

Average liquid assets after increasing the coefficient of turnover can be expressed as

$$\text{average liquid assets}(ia) = \frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ia)} \quad (5)$$

where

i – marketable securities (1), receivables (2) or inventory (3),

financial effects (i) – annual investment in marketable securities, annual sales, cost of goods sold,

coefficient of turnover (ia) – coefficient of turnover after increasing its value.

Average liquid assets before increasing the coefficient of turnover can be expressed as

$$\text{average liquid assets } (ib) = \frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ib)} \quad (6)$$

where

i – marketable securities (1), receivables (2) or inventory (3),

financial effects (i) – annual investment in marketable securities, annual sales, cost of goods sold,

coefficient of turnover (ib) – coefficient of turnover before increasing its value.

Decreasing the amount of liquid assets can be expressed as follows:

$$\text{decrease in liquid assets} = \sum_{i=1}^3 \left(\frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ib)} - \frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ia)} \right) + \text{decrease in cash} \quad (7)$$

After rearrangement we obtain

$$\text{decrease in liquid assets} = \sum_{i=1}^3 \text{financial effects } (i) \left(\frac{1}{\text{coefficient of turnover } (ib)} - \frac{1}{\text{coefficient of turnover } (ia)} \right) + \text{decrease in cash} \quad (8)$$

where

i – marketable securities (1), receivables (2) or inventory (3),

financial effects (*i*) – annual investment in marketable securities, annual sales, cost of goods sold,

coefficient of turnover (*ia*) – coefficient of turnover after increasing its value,

coefficient of turnover (*ib*) – coefficient of turnover before increasing its value.

It will be convenient to define independent variables that determine net savings through decreasing the amount of liquid assets. The independent variables that determine net savings through decreasing the amount of liquid assets are as follows:

- decrease in cash
- financial effects (*i*) (annual cost of goods sold, annual sales, annual investment in marketable securities)
- coefficients of turnover after increasing their value
- coefficients of turnover before increasing their value
- rate of return on investment
- interest rate
- profit tax.

This leads us to introduce a new model for calculating net savings through decreasing the amount of liquid assets. The relations between independent variables that determine net savings can be established as follows:

$$\begin{aligned} \text{net savings} = & \left[\sum_{i=1}^3 \left(\frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ib)} - \frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ia)} \right) \right. \\ & \left. + \text{decrease in cash} \right] \times \frac{(\text{rate of return on investment} - \text{interest rate})}{100} \\ & \times \left(1 - \frac{\text{profit tax}}{100} \right) \end{aligned} \tag{9}$$

where

i – marketable securities (1), receivables (2) or inventory (3),

financial effects (*i*) – annual investment in marketable securities, annual sales, cost of goods sold,

coefficient of turnover (*ia*) – coefficient of turnover after increasing its value,

coefficient of turnover (*ib*) – coefficient of turnover before increasing its value,

profit tax – expressed as percentage.

After rearrangement we obtain

$$\begin{aligned} \text{net savings} = & \left[\sum_{i=1}^3 \text{financial effects } (i) \left(\frac{1}{\text{coefficient of turnover } (ib)} \right. \right. \\ & \left. \left. - \frac{1}{\text{coefficient of turnover } (ia)} \right) + \text{decrease in cash} \right] \\ & \times \frac{(\text{rate of return on investment} - \text{interest rate})}{100} \times \left(1 - \frac{\text{profit tax}}{100} \right) \end{aligned} \tag{10}$$

where

i – marketable securities (1), receivables (2) or inventory (3),
 financial effects (i) – annual investment in marketable securities, annual sales, cost of goods sold,

coefficient of turnover (ia) – coefficient of turnover after increasing its value,
 coefficient of turnover (ib) – coefficient of turnover before increasing its value,
 profit tax – expressed as percentage.

As lowering liquid assets can result in excess amount of liquid assets for investment, the excess cash or excess liquid assets can be invested that should create new value and increase the firm's value. Therefore, the expected rate of return on investment should be greater than the interest rate on short-term debt or the costs of financing excess liquid assets.

We must ensure that this condition is met in our decision to invest excess cash or decrease in liquid assets: net savings $>$ costs of financing $\times (1 - \text{profit tax}/100)$. If net savings through decreasing the amount of liquid assets and investing excess cash is greater than the costs of financing excess cash multiplied by $(1 - \text{profit tax}/100)$, the excess cash or drop in liquid assets should be invested. If net savings through decreasing the amount of liquid assets and investing excess cash is not greater than the costs of financing excess cash multiplied by $(1 - \text{profit tax}/100)$, the financial manager should decide not to invest excess cash and to reduce current liabilities equally to a reduction in liquid assets.

As lowering liquid assets can result in a reduction of their sources of financing or short-term debt and costs of financing, S.M.E. can produce net earnings which is equal to the costs of financing the reduction in liquid assets.

If the drop in liquid assets results in a lowering of current liabilities or short-term debt, the net savings is equal to the costs of financing the reduction in liquid assets and it can be expressed as follows

$$\text{net savings} = \frac{\text{decrease in liquid assets} \times \text{interest rate}}{100} \times \left(1 - \frac{\text{profit tax}}{100}\right) \quad (11)$$

where

interest rate – expressed as percentage,

profit tax – expressed as percentage.

It will be convenient to rewrite decrease in liquid assets as follows:

$$\begin{aligned} \text{decrease in liquid assets} &= \sum_{i=1}^3 \left(\frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ib)} \right. \\ &\quad \left. - \frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ia)} \right) + \text{decrease in cash} = \sum_{i=1}^3 \text{financial effects } (i) \\ &\quad \left(\frac{1}{\text{coefficient of turnover } (ib)} - \frac{1}{\text{coefficient of turnover } (ia)} \right) + \text{decrease in cash} \end{aligned} \quad (12)$$

where

i – marketable securities (1), receivables (2) or inventory (3),

financial effects (i) – annual investment in marketable securities, annual sales, cost of goods sold,

coefficient of turnover (ia) – coefficient of turnover after increasing its value,

coefficient of turnover (ib) – coefficient of turnover before increasing its value.

The net savings through decreasing current liabilities can be re-expressed as follows:

$$\begin{aligned} \text{net savings} = & \left[\sum_{i=1}^3 \left(\frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ib)} - \frac{\text{financial effects } (i)}{\text{coefficient of turnover } (ia)} \right) \right. \\ & \left. + \text{decrease in cash} \right] \times \frac{\text{interest rate}}{100} \times \left(1 - \frac{\text{profit tax}}{100} \right) \end{aligned} \quad (13)$$

where

i – marketable securities (1), receivables (2) or inventory (3),

financial effects (i) – annual investment in marketable securities, annual sales, cost of goods sold,

coefficient of turnover (ia) – coefficient of turnover after increasing its value,

coefficient of turnover (ib) – coefficient of turnover before increasing its value,

interest rate – expressed as percentage,

profit tax – expressed as percentage.

After rearrangement, we obtain

$$\begin{aligned} \text{net savings} = & \left[\sum_{i=1}^3 \text{financial effects } (i) \left(\frac{1}{\text{coefficient of turnover } (ib)} \right. \right. \\ & \left. \left. - \frac{1}{\text{coefficient of turnover } (ia)} \right) + \text{decrease in cash} \right] \\ & \times \frac{\text{interest rate}}{100} \times \left(1 - \frac{\text{profit tax}}{100} \right) \end{aligned} \quad (14)$$

where

i – marketable securities (1), receivables (2) or inventory (3),

financial effects (i) – annual investment in marketable securities, annual sales, cost of goods sold,

coefficient of turnover (ia) – coefficient of turnover after increasing its value,

coefficient of turnover (ib) – coefficient of turnover before increasing its value,

interest rate – expressed as percentage,

profit tax – expressed as percentage.

These models show how by increasing the coefficient of turnover of different liquid assets an S.M.E. can reduce the average liquid assets as well as increase the amount of liquid assets or surplus cash available for investments. Through investing surplus cash or through decreasing current liabilities as well as costs of financing excess cash an S.M.E. can produce net earnings and improve profitability.

On the basis of the new equation models offered for calculating net savings through decreasing the amount of liquid assets and net savings through reducing current liabilities, the following benefits can be derived:

Table 4. Analysis of liquid assets at G.E.P. Manufacturing Company.

Liquid assets	Financial effects (<i>i</i>) (EUR)	Average investment in liquid assets (EUR)	Coefficient of turnover (<i>ib</i>)	Coefficient of turnover (<i>ia</i>)
Inventories	10,000,000	2,500,000	4	8
Receivables	9,000,000	1,500,000	6	12
Marketable securities	4,000,000	1,000,000	4	6

- The models can help management better understand business and its functional relationships.
- These models can help to improve decision making ability in liquidity management and to maintain adequate liquidity.
- More accurate forecasts can be made as well as significant cost savings can be achieved.

4.1. An illustrative example

These models for calculating net savings can be tested and used for business practice. In order to illustrate our approach and validate the results from the model for calculating net savings through decreasing the amount of liquid assets, we offer the following example. G.E.P. Manufacturing Company would increase its coefficients of turnover: inventory turnover, receivables turnover and turnover of marketable securities.

Financial effects (annual cost of goods sold, annual sales and annual investment in marketable securities) as well as G.E.P.'s average investments in inventories, receivables and marketable securities are presented in Table 4. G.E.P. Manufacturing Company plans to increase inventory turnover and receivables turnover by 100 per cent as well as to invest excess cash. The turnover of marketable securities will increase by 50 per cent. The coefficients of turnover before increasing their value and after increasing their value are calculated and presented in Table 4.

Profit tax rate is assumed to be 20 per cent. Assuming the firm's rate of return on investment is 15 per cent and the interest rate on the short-term bank loan is 7 per cent, the analysis would proceed as follows.

Analysis:

$$\begin{aligned} \text{net savings} = & \left[\sum_{i=1}^3 \text{financial effects } (i) \left(\frac{1}{\text{coefficient of turnover } (ib)} \right. \right. \\ & \left. \left. - \frac{1}{\text{coefficient of turnover } (ia)} \right) + \text{decrease in cash} \right] \\ & \times \frac{(\text{rate of return on investment} - \text{interest rate})}{100} \\ & \times \left(1 - \frac{\text{profit tax}}{100} \right) = 149.333,30 \text{ EUR} \end{aligned}$$

where

i – marketable securities (1), receivables (2) or inventory (3),

financial effects (i) – annual investment in marketable securities, annual sales, cost of goods sold,

coefficient of turnover (ia) – coefficient of turnover after increasing its value,

coefficient of turnover (ib) – coefficient of turnover before increasing its value,

profit tax – expressed as percentage.

By using the model for calculating net savings through decreasing the amount of liquid assets, we calculate the net savings and find that the net earnings are 149,333.30 EUR.

Decision:

The excess cash or decrease in liquid assets should be invested as net profitability occurs.

5. Conclusion

This paper highlights the importance of efficient liquidity management for S.M.E.s. This implies establishing an appropriate liquidity policy, ensuring adequate liquidity as well as reducing the amount of liquid assets in order to invest surplus cash and maximise rate of return.

The paper contributes to literature on the management of liquidity by firstly, defining independent variables which determine net savings through decreasing the amount of liquid assets and, secondly, by modelling the relationships between these variables in order to produce net savings through reducing liquid asset and investing surplus cash. Finally, new models for calculating net savings through decreasing the amount of liquid assets or current liabilities have been designed on the basis of the analysed results which can help to ensure that reducing the amount of liquid assets will result in net savings and can help managers in managing liquidity optimally. With these models an enterprise can consider net profitability through decreasing the amount of liquid assets and investing surplus cash or through reducing current liabilities in order to improve its income and profitability.

This study has provided empirical evidence of a negative relationship between liquidity expressed in terms of current assets to current liabilities ratio and S.M.E.s' profitability expressed in terms of return on assets. Our findings indicate that managers should aim to keep as close to the optimal liquidity level as possible and try to avoid any deviation in order to maximise the profitability of an S.M.E.

As a limitation of our study, it should be noted that the study is based on secondary data taken from the published annual reports of the selected enterprises. In Croatia, small and medium-sized companies can prepare an abridged financial statement which is, therefore, less elaborate and presents less detailed information than the financial statement of large companies. Some of the information required for this study is, therefore, unavailable for such companies. The study is also based on ratio analysis, which has its own limitations. In the future, some empirical researches are suggested with larger sample size.

A new approach to the management of liquid assets based on mathematical modeling motivates future research in the area of liquidity management, and it would be interesting to extend the developed mathematical models in the future.

Disclosure statement

No potential conflict of interest was reported by the authors.

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