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Liquidity, cash conversion cycle and financial performance: case of Russian companies

Abstract

Managing liquidity and the cash conversion cycle play an important role in running a business successfully. Company officials must be confident that their organization does not suffer a shortage or a surplus of payment means and they must be ready to cover current liabilities when necessary. At the same time, the management's aim is an increase in the company's returns. The research covers the influence of the current liquidity ratio and cash conversion cycle on financial performance (as a return on net operating assets, RNOA) of Russian companies. A regression analysis of 720 Russian companies engaged in various economic activities for the period 2001 to 2012 was performed with Stata 12.0. The companies in the sample represent the following industries: telecommunications, transport, electric power industry, trade, metallurgy, mechanical engineering, chemical and petrochemical, oil and gas. The authors find an inverse relation between the Russian companies' cash conversion cycle and RNOA. Further research revealed that companies should seek to obtain a zero cash conversion cycle in order to increase their rate of return. The study also indicated a positive relation between companies' current liquidity ratio and RNOA. This means that Russian companies should augment their current liquidity ratio in order to increase the RNOA, but the ratio should only be augmented to a defined value. In the paper we also present the calculations of the recommended intervals of current ratio for the analyzed economic sectors for the contemporary economic situation in Russia.

Keywords: liquidity, current liquidity ratio, cash conversion cycle, financial performance, Russian companies.
JEL Classification: G32.

Introduction

Any organization requires correct and proper planning of the whole range of its activities if it is to be effective. This means planning in such spheres as marketing, production, human resource management and, naturally, financial management. Nowadays, regulation of current liquidity, cash conversion cycle and return ratio (profitability) forms a considerable part of financial management.

The management of working capital plays a significant role in a company's activity. The primary reason for this is that a company's current operations (production process, financial relations with customers and suppliers, etc.) are mainly determined by its working capital – i.e. by planning the duration of the cash conversion cycle and the operating cycle – and its current liquidity ratio (current ratio). Thus, the management of the working capital and current ratio directly affects the results of a company's business. As a consequence, it assists in reaching the primary objective of a company within the concept of value-based management which implies maximization of shareholder value.

Research results confirm that the use of incorrect working capital management models is likely to decrease the return ratio of an organization and therefore cause its insolvency (Blagikh and Salnikov, 2010). The issuance of working capital management has assumed special importance in the context of the Global Financial Crisis as it made many companies and even whole economic sectors consider the problem of economic survival. It should be noted that the given issue is barely discussed in any research papers and monographs. Most studies (Kamath, 1989; Jose, Lancaster and Stevens, 1996; Shin and Soenen, 1998; Deloof, 2003; Eljelly, 2004; Lazaridis and Tryfonidis, 2006; Garcia-Teruel and Martinez-Solano, 2007; Dong and Su, 2010; Volkov and Nikulin, 2012) were based on samples of data that did not include the periods of economic crisis. However, regarding companies' financial management, it would be interesting to find out whether a financial crisis in any way affects any existing specific relations between working capital, current ratio and return ratio.

The main motivation for the paper is the importance of research in the sphere of managing cash conversion cycles and current ratios in Russian companies and defining their influence on financial results is very limited and underestimated (Volkov, Nikulin, 2012). Historically, due to high inflation and country risk, the financing lending rates in Russia are quite high in comparison to rates in the USA and Europe (Table 1).

Table 1. Average lending rates 2010-2014

Country	Average lending rate (%)
The USA	6.0
Europe	5.9
Russia	9.5

Source: http://data.worldbank.org/indicator/FR.INR.LEND/countries.

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Consequently, all Russian companies have fewer alternatives of external finance available to them, making them more dependent on short-term finance and especially on accounts payable. In this case, proper and efficient management of cash conversion cycles and current ratios are of strategic importance for Russian companies.

We think that the determination of a financial management policy implies a solution to the following major task: what volume of working capital does a company need to ensure effectiveness, on the one hand, and maintain its solvency, on the other? Thus, the practical need for competent management of a company's current operations makes it important (and relevant) to research the peculiarities of managing the current ratio, cash conversion cycle and return ratio within the declared objectives of a company.

Consequently, the goal of our research is to determine the influence of current liquidity ratio and cash conversion cycle on the return on net operating assets (RNOA's) of the Russian companies.

Thus the paper contributes to prior research in the field in a number of ways. First, this is one of the first papers that analyzes the influence of working capital and current liquidity ratio on return of Russian companies. Secondly, we take into consideration and analyze the change (if there is any) before and after the Global Financial Crisis. Thirdly, the paper investigates the relation between cash conversion cycle, current ratio and firm performance by taking a wide range of industries into consideration. Fourthly, we analyze the panel data with OLS and fixed and random-effects approaches in order to define the most adequate method of analysis. Our results show that in the Russian market there is an inverted U-shaped relation between current liquidity ratio and return on assets. This means that current ratio and financial performance relate positively at low levels and negatively at higher levels. Lastly, on the basis of the sample data we define the optimum level of the cash conversion cycle that increases returns with the optimum current liquidity ratio. The results of the research have high practical implications for the efficient management of Russian companies.

In the first part of the research we review the publications related to the examined issue. In the second part we describe the research methods employed, formulate our hypothesis and make a regression model. In the last part we analyze the results obtained, and provide practical recommendations for the application of gathered data in an empirical study.

1. Literature review

Rather a large number of research papers related to this problem emerged worldwide in order to help identify the target values of cash conversion cycles. The values need to be determined in order to increase the rate of return and to maintain the necessary level of liquidity. In recent years economists have conducted a considerable number of studies devoted to the interconnection between companies' liquidity, cash conversion cycle and return ratio. Our research is the first to be based on a large sample of Russian companies over a period of 12 years.

We noted that the given interconnection did not prove to be statistically significant in all previous studies. For instance Jose, Lancaster and Stevens (1996) investigated a large sample of companies from seven different economic sectors (mineral resources, construction, production, services, trade, financial services, and professional services) for a period of twenty years. Upon analyzing the influence of the cash conversion cycle on return on assets, they concluded that the examined indicators are in inverse ratio. However, the research showed that there was no statistically significant interconnection between these indicators in the field of construction and financial services. Such research confirms that the results of a study seriously depend on the choice of the economic sector and observation period, and perhaps on some other factors. At the same time, considering the samples of data (used in the aforementioned studies) in general, we see that all the research publications reveal rather a strong statistically significant inverse linear interdependence between a company's cash conversion cycle and return ratio (profitability) (Al-Shubiri and Mohammad Aburumman, 2013; Jose, Lancaster and Stevens, 1996; Lazaridis and Tryfonidis, 2006; Shin and Soenen, 1998; Yucel and Kurt, 2002).

Shin and Soenen (1998) analyzed a sample of 58,985 companies in the period 1975 to 1994. They confirmed the hypothesis about a strong inverse relation between companies' net trade cycle and return ratio. With the results in hand, the authors concluded that shareholder value can be increased by a reduction of the net trade cycle. Lazaridis and Tryfonidis (2006) arrived at the same conclusion: managers can generate revenues for their company by correctly regulating the cash conversion cycle and keeping each component of this cycle at an optimum level.

The researchers also had to solve a number of subsidiary tasks during their studies, for example: which of the indicators should be selected when evaluating return on assets? Some researchers chose return on investments (Bhunia, Bagachi and Khamrui, 2012), return on capital employed (Bhunia and Das, 2012), net operating income (Eljelly, 2004), return on equity (Ching, Novazzi and Gerab, 2011; Jose, Lancaster and Stevens, 1996; Yucel and Kurt, 2002), and return on assets (Bhunia, Bagachi and Khamrui, 2012; Ching, Novazzi and Gerab, 2011; Jose, Lancaster and Stevens, 1996; Sen and Oruc, 2009; Volkov and Nikulin, 2012; Yucel and Kurt, 2002).

On the whole, more recent studies performed in various countries also confirm the conclusions of previous research about the inverse relation between cash conversion cycle and return on assets (Bhunia, 2010; Bhunia, Bagachi and Khamrui, 2012; Dong and Su, 2010; Volkov and Nikulin, 2012). For instance, Volkov and Nikulin (2012) examined the issues of working capital management based on the data of 73 Russian companies. The primary goal they pursued was to determine the nature of the interrelation between a company's cash conversion cycle, current ratio and return on assets. The research proved that one option for Russian companies (that operate in an environment of quite high lending rates) in order to increase liquidity, which is expressed by means of current ratio, is to extend their cash conversion cycle; meanwhile, in order to improve the rate of return, they have to bring the cash conversion cycle as close to zero as possible. The researchers also revealed an inverse relation between the cash conversion cycle (net trade cycle) and return on assets.

We contribute to the prior research by analyzing the data sample of 720 Russian companies. We expect to find the optimum intervals of the cash conversion cycle that lead to an increase in return on assets. We also take into consideration a large number of industries and define how the Global Financial Crisis influences the relationship between the variables, which brings additional novelty to the research.

A number of economists have also studied the influence of liquidity on a company's rate of return and got controversial results. For example, Raheman and Nasr (2007) analyzed 94 Pakistani enterprises trading on the exchange and came to the conclusion that a company's liquidity and rate of return are inversely related, while a company's size and rate of return are directly related. A similar study was performed by Eljelly (2004). Upon analyzing the data from a sample of 29 Saudi Arabian companies working in three main areas and trading on a financial exchange, the author concluded that there is a statistically significant inverse relation between the current ratio and return ratio of these companies. Moreover, the research showed that the size of an enterprise exerts some influence on the return ratio of companies engaged in other economic sectors. However, this correlation is not observed in the whole sample of enterprises. Other researchers (Yucel and Kurt, 2002) also come to these conclusions. However, individual research studies proved that there is a statistically significant direct relation between companies' liquidity (current ratio) and rate of return (Sharma and Kumar, 2011; Bhunia, 2010). Both the studies mentioned above were conducted on a sample of companies from different economic sectors in India.

Our research is going to be the first one based on a large sample of Russian companies where we define the relationship between current ratio and rate of return. We contribute not only to prior literature, but also make a practical contribution by calculating the optimal level of current liquidity ratio for different Russian companies from different industries that help to maintain the highest returns. We find an inverse U-relationship between current liquidity and rate of return, and not sticking to the proposed intervals will decrease the return on net operating assets.

2. Hypotheses development

An analysis of the theoretical literature and empirical studies performed in various countries allowed us to formulate a few basic hypotheses for this research.

First of all, we assume that there can be an inverse relation between a company's rate of return and cash conversion cycle. If a company manages its cash efficiently that will help to increase the present value of the cash. Thus a shorter cash conversion cycle may lead to higher returns. By analogy with the previous studies (Jose, Lancaster and Stevens, 1996; Lazaridis and Tryfonidis, 2006; Shin and Soenen, 1998; Yucel and Kurt, 2002) we suppose that an increase in the cash conversion cycle which occurs on account of additional investments in inventories and accounts receivable leads to a decrease in the return on assets. Consequently, to improve the rate of return, companies should reduce their cash conversion cycle:

Hypothesis 1. An increase in a company's cash conversion cycle entails a decrease in its rate of return.

A high rate of return achieved by an enterprise testifies to a rather successful operation by this enterprise. In this case we should note that short-term difficulties with liquidity (and, accordingly, low values of current ratio) may indicate a dynamic development of an enterprise, rapid growth of turnover and quick assimilation into the market. Moreover, this may not necessarily mean financial problems and insolvency. Nevertheless, some companies often sacrifice either a good rate of return or a high level of liquidity in an attempt to combine dynamic development with sufficient means of payment and high solvency. Therefore, a company must have a balance between these two variables. It is also very important that there is an optimum level as any profit goal should not be at the cost of the illiquidity problems.

Consequently, we may say that under conditions of globalization, enterprises are forced to resolve the 'liquidity/rate of return' dilemma, i.e. they have to

seek the desired optimum correlation between current ratio and the rate of return (Eljelly, 2004; Raheman and Nars, 2007; Smith and Begemann, 1997). Thus, we assume that there can be an inverse relation between a company's rate of return and current ratio, i.e. an increase in the current ratio entails a reduction in the rate of return and vice versa.

Hypothesis 2. An increase in the current liquidity ratio of a company leads to a reduction in its rate of return.

The formulated hypotheses were empirically tested with the help of econometric methods.

3. Methodology

The research model by Eljelly (2004) was chosen for our study:

$$NOI = \beta_0 + \beta_1 \times CR + \beta_2 \times CCC + \\ + \beta_3 \times LOGTA + u, \quad (1)$$

where *NOI* is net operating income, *CR* is current ratio, *CCC* is cash conversion cycle, *LOGTA* is the logarithm of total assets, β_j is a parameter before a quantitative variable, and *u* is the random component of the research model.

The model was modified to achieve the goal of the present research. First of all, we decided to use the return on net operating assets (calculated as EBI^j (earnings before interest adjusted) divided by *NOA* (net operating assets) as a dependent variable because this indicator reflects a company's operating performance most accurately (Volkov and Nikulin, 2009). Secondly, we introduced dummy variables into the research model in order to obtain more accurate data: one of them shows a company belongs to a specific economy sector (either production or services), and the other reflects the company's operational period (the pre-crisis period, the crisis period or the post-crisis period). We also added several interaction variables to the model to get a deeper understanding of the relationship between the variables.

Thus, the following research model was selected as a basic instrument to test the formulated hypotheses:

$$RNOA_{it} = \beta_0 + \beta_1 \times CCC_{it} + \beta_2 \times CR_{it} + \\ + \beta_3 \times LOGTA_{it} + \beta_4 \times S + \beta_5 \times P_n + \\ + \beta_6 \times S * CCC_{it} + \beta_7 \times S * CR_{it} + \\ + \beta_8 \times S * LOGTA_{it} + \beta_9 \times S * P_1 + \\ + \beta_{10} \times S * P_2 + u_{it}, \quad (2)$$

where β_j is a parameter before a variable; u_{it} is the random component of the model; i = 1,…, 90; t = 2001,…, 2012; the index t corresponds to the observation periods, while the index i reflects the observations for each period. The following independent variables were used in the model: liquidity of a company (current ratio – *CR*, calculated as current assets, divided by current liabilities) and its cash conversion cycle (*CCC=ITP+ARP-APP*, where *CCC* is a company's cash conversion cycle, *ITP* is the inventory turnover period, *ARP* is the accounts receivable period, and *APP* is the accounts payable period); as well as two dummy variables – a company's area of activity (*S*) and the corresponding period of activity (P_n) – which will be described below.

As the sample includes companies of different scale, the control variable represented by the logarithm of total assets (LOGTA) was employed in order to attain more accurate results. This ensured uniformity in the drawn sample according to the scale of the companies.

We also added the interaction variables S*CCC, S*CR, S*LOGTA, S*P_1, S*P_2 to the model to get better insights about the sample and relationship between the variables.

To reflect the specific nature of an economic sector, the variable S (Sector) which shows a company's area of activity was included in the model. The examined indicator has two values (S = 1 if a company is engaged in production and S = 0 if not, i.e. the company is engaged in services).

In order to reflect the specific character of the periods, we also included the dummy variable P_n (Period) into the model (P_1 = 1 the pre-crisis period is analyzed, P_1 = 0 if not; P_2 = 1 if the post-crisis period is analyzed, P_2 = 0 if not).

The evaluated regression models were compared pair wise to get the most adequate ones.

1. Comparison of the pooled regression model with the fixed effects regression model (the Wald test).
2. Comparison of the pooled regression model with the random effects regression model (the Breusch-Pagan test).
3. Comparison of the random effects regression model with the fixed effects regression model (the Hausman test).

The tests revealed that the random effects regression model appears to describe the examined empirical data the most adequately.

4. Data collection

The research sample is comprised of data from 720 Russian companies for the period 2001 to 2012. The companies were engaged in the following economic sectors (Table 2).

Table 2. Description of companies included in the research sample

Company's area of activity	Economic sector	Number of companies in the sample
Services	Telecommunications	90
	Transport	90
	Electric Power Industry	90
	Trade	90
	Total number of companies engaged in services	360
Production	Metallurgy	90
	Mechanical engineering	90
	Chemical and petrochemical	90
	Oil and gas	90
	Total number of companies engaged in production	360
Total	Number of companies in the sample	720

Economic sectors were selected to embrace the various companies' activities (services and production) in the study. After an analogy with the research performed by other authors, we excluded financial and agricultural companies from our investigation. The companies were ranked according to the size of their gross profit; the presented ratings (top 200) of the companies in the various economic sectors were examined for one of the observation periods with the help of the electronic information resource SPARK (professional market and company analysis system[1]).

The data from the chosen companies' official annual reports for the period 2001-2012 were analyzed statistically for this research. The authors decided to divide the initial sample into three periods which reflect the possible changes (linked with the Global Financial Crisis): the pre-crisis period (2001-2007), the crisis period (2008-2009) and the post-crisis period (2010-2012).

All the data used to calculate the financial indicators were collected based on the companies' financial statements issued in compliance with Russian standards. The descriptive statistics presented in Table 3 (see Appendix) summarize the initial results of performance.

The following conclusions can be drawn from Table 3. The sample was comprised of both profitable and unprofitable (those with a negative return ratio in a defined period of time) companies. However, we may say that, on average, the return ratio of the Russian companies remained at 18% during the studied period (from 2001 to 2012). Analyzing the descriptive statistics of the subsamples of the companies (i.e. production industry vs. services), we can conclude that the rate of return in the companies engaged in services is on average higher than that of the enterprises involved in production.

The return ratio of service companies was 18.53%, while the return ratio of production companies was on average equal to 17.82%. The research results show that the economic sectors with the lowest rate of return include metallurgy (15.04%), transport (15.00%) and mechanical engineering (15.22%) whereas the economic sectors yielding the highest rate of return were trade (22.12%), oil and gas industry (21.11%) and telecommunications (20.13%).

As can be seen from Table 3 (see Appendix), the cash conversion cycle assumes both negative and positive values; it equals, on average, 44 days. However, if we consider the services and production industry separately, we see that the values of the cash conversion cycle differ by almost a factor of two, on average: 30.53 days and 58.3 days, respectively. It should be noted that the shortest average cash conversion cycle was observed in telecommunications (12.92 days), while the longest one was registered in chemical and petrochemical (68.06 days).

In order two check whether the means between the production and service company subsamples are statistically different, we conducted t-tests. The results of the t-test are provided below in Table 4.

Table 4. t-test results

	RNOA		CCC		CR		LOGTA	
	Production	Service	Production	Service	Production	Service	Production	Service
Mean	17.82	18.53	58.3	30.53	1.926	1.981	9.17	8.84
St. deviation	19.04	20.44	58.81	49.63	1.745	1.884	0.93	1.03
Variance	362.52	417.79	358.62	263.14	3.045	3.549	0.865	1.061
t-statistics	2.4138		2.1626		2.9995		2.9614	
P(T<=t) one-tail	0.0209		0.0336		0.0211		0.0219	
t critical one-tail	1.9199		1.9199		1.9199		1.9199	

[1] SPARK, professional market and company analysis system, accessed February 10, 2013, http://www.spark-interfax.ru/Front/Index.aspx.

Table 4 (cont.). t-test results

	RNOA		CCC		CR		LOGTA	
	Production	Service	Production	Service	Production	Service	Production	Service
P(T<=t) two-tail	0.0417		0.0371		0.0423		0.0438	
t critical two-tail	2.3027		2.3027		2.3027		2.3027	

Since the p-values for all the variables are less than 0.05 = α, we reject the null hypothesis, concluding that there is a significant difference of variance between the two subsamples concerning each of the variables. We also conducted a test to check whether there are statistically significant differences of variance between the variables of the different production and service companies. The results confirm the conclusions we made about the difference in variance between the variables of both subsamples.

The results of the correlation analysis are provided below in Table 5.

Table 5. The results of the correlation analysis between variables

	RNOA	CCC	CR	LOGTA
Return on net operating assets (RNOA)	1	-	-	-
Cash conversion cycle (CCC)	-0.069	1	-	-
Current liquidity ratio (CR)	0.102	0.246	1	-
Logarith of total assets (LOGTA)	0.013	0.189	-0.024	1

As can be seen from the correlation analysis, the cash conversion cycle is negatively correlated to return on net operating assets. There is also a positive correlation between current liquidity ratio and return. From a further analysis we know that if the current liquidity ratio is limited the return will decrease. Furthermore, the larger companies seem to be better at generating returns.

5. Regression analysis results

As mentioned above, the tests indicated that the random effects regression model appears to be the most adequate to describe the examined empirical data. Evaluations of the coefficients of the given regression model are provided in Table 6.

When describing the variables. We pointed out that the return on net operating assets (RNOA) is used as a dependent variable.

An F-test of the regression model showed that it is statistically significant. In order to identify the degree of multicollinearity in the regression model – i.e. the degree of the linear relationship between independent (predictor) variables of the regression model. We evaluated the variance inflation factor (VIF). In the examined model the average variance inflation factor is equal to 1.14. Thus, the VIF is lower than 4, and consequently there is no linear relation between the independent variables. We also tested the regression model for heteroscedasticity to ensure accuracy of the evaluations made and hence that of the results received and the conclusions drawn about the statistical significance of the regression model. The Breusch–Pagan test showed that the dispersion of random variables of the regression model is constant, which testifies there is no heteroscedasticity.

In general, the statistical significance of the regression model is indicated by the high value of the Wald statistic: Wald chi2(6) = 110.12. Furthermore, the predictor variables of the regression model are uncorrelated with the unobserved random effects (this is indicated by expression corr (u_i. X) = 0 (assumed). Hence one can conclude that the evaluations of the given regression model are consistent.

Table 6. Evaluation of the random effects regression model (2)

Characteristic	Intercept	CCC	CR	LOGTA	S	P_1	P_2	S*CCC	S*CR	S*LOGTA	$S*P_1$	$S*P_2$
Coefficients	6.298 (2.2)	-0.023*** (-5.07)	0.012*** (8.64)	0.745** (2.53)	-2.306** (-3.14)	0.314 0.58	-0.419 (-0.64)	-0.053** (-2.4)	0.028*** 3.24	1.718** 2.96	0.724 (0.24)	-0.966 (-0.65)
P-value	2.859	0.003	0.004	0.012	0.041	0.639	0.692	0.012	0.002	0.1156	0.423	0.252
P-value Hausman test	0.823											
R^2 within R^2 between R^2 overall	0.390 0.317 0.363											
Wald statistic	Wald chi2(6) = 110.12											
Statistical significance of the regression model (F-test)	0.0000											

Note: Z-test statistics are given in brackets, ***, **, * Significant at the 1%, 5% and 10% levels respectively.

The Z-test results show that a statistically significant relation is observed between the return on net operating assets and all the independent variables (with the exception of the dummy variables reflecting specific periods and some of the interaction variables). The statistical insignificance of dummy variables P_1 and P_2 means that the research results will not be different regardless of the study period selected (the pre-crisis period, the crisis period or the post-crisis period). The interaction variables that include dummy variables P_1 and P_2 are also insignificant. This reflects that there is no difference in relationship between the production or service company variables, before and after the crisis. In other words, regardless of the study period (and regardless of the Global Financial Crisis) the strength of the regression model and of the relation between the independent variables and return on net operating assets will remain approximately the same. To provide additional confirmation of this fact, we tested the statistical significance of the group of dummy variables as a whole. The test results also confirm the aforementioned conclusion: dummy variables P_1 and P_2 are statistically insignificant (the significance of the F-test statistic is 0.5815).

The dummy variable which reflects the specific nature of a company's area of activity (S_1) turned out to be statistically significant. This denotes that a company's area of activity exerts an influence on a dependent variable. Thus, the coefficient occurring before variable S (-2.306) indicates that the rate of return in production industries is generally lower than that in services.

The control variable (LOGTA) also appears to be statistically significant. Additionally, in the general sample of companies, this indicator directly affects the return on net operating assets. However, the correlation between the indicators differs among the economic sectors. Thus, we may say that the size of a company can influence its liquidity, cash conversion cycle and hence its rate of return to a certain degree. Large companies are able to purchase materials in considerable volumes so that they can receive a discount on them, which is impossible for small enterprises and they can count on getting certain discounts from suppliers who have relatively small quantities of materials in stock. Moreover, large companies can arrange credits with their suppliers under favorable terms and they are more successful in creating accounts receivable than small enterprises. Due to the aforementioned factors, the liquidity and cash conversion cycle of large companies may be less than those of small enterprises. This result accords with the conclusions drawn by Yucel and Kurt (2002), Eljelly (2004) and Sen and Oruc (2009). The statistical significance of the interaction coefficient S*LOGTA leads to the conclusion that in the Russian market, size has a greater influence on return on net operating assets regarding production companies in comparison to service companies.

A negative cash conversion cycle value signifies that other conditions being equal a company's cash conversion cycle and rate of return are inversely related. Hence, on average companies should reduce their cash conversion cycle with the aim of increasing their return on assets. The result obtained accords with the conclusions of previous research (Bhunia, 2010; Sen and Oruc, 2009; Dong and Su, 2010; Bhunia, Bagachi and Khamrui, 2012; Volkov and Nikulin, 2012). Thus, the results of the study confirm hypothesis 1 which suggests that a company's cash conversion cycle and rate of return are inversely related.

The conclusion from the aforementioned studies is that companies need to reduce their cash conversion cycle down to a defined limit to improve the rate of return. We also verify this result: if a company has a positive cash conversion cycle. It should attempt to reduce it; and on the contrary if a company has a negative cash conversion cycle it should attempt to increase it up to an 'optimum' value. In such a situation a company will not experience a cash deficiency and will not have to seek financing for its operations from external sources. As the cash conversion cycle of the examined companies equals 44 days on average we may conclude that the majority of Russian companies should seek to lower their cash conversion cycle down to a zero value.

The influence of current liquidity ratio on a company's rate of return is statistically significant and this ratio has a direct effect on the return on net operating assets. In other words, an increase in current ratio entails an increase in a company's rate of return; moreover, this dependence is registered in the subsamples of all the examined economic sectors. This fact disproves hypothesis 2 suggesting that there is a statistically significant inverse relation between liquidity and rate of return. A similar result was obtained in the papers by Bhunia and Das (2012) and Sharma and Kumar (2011). This result may be interpreted in the following way: an increase in current ratio implies an increase in a company's current assets (or a decrease of its current liabilities); this can lead also to an increase in a company's rate of return. If the given correlation is used 'correctly' (for example, if surplus cash is skillfully used on income-bearing investments. or if liabilities are discharged in advance, etc.).

The interaction variables that include the dummy variable S show us that the negative influence of a cash conversion cycle on RNOA regarding production companies is higher than in service companies. At the same time the current ratio in production companies has a higher positive influence on the return of net operating assets. This means it is even more important for production companies to manage the cash conversion cycle and current ratio properly as the influence on RNOA is higher in comparison to service companies.

One should note, however, that the relation between rate of return and current ratio will remain direct only to a certain extent. In order to determine at which point the relation between the studied indicators becomes inverse, we decided to define the polynomial trend line that is determined by the following equation:

$$RNOA = -2.199 \times CR^2 + \\ +13.754 \times CR + 0.999. \quad (3)$$

Thus, with the help of equation (3) we can determine the specific values of the examined indicators at which the relation between current ratio and return on net operating assets becomes inverse for the whole sample in general. In the given case the CR and RNOA values are the following: CR equals 3.127; and RNOA equals 22.50%.

Hence, on average, companies should seek to keep their current ratio below 3.127; at a given current ratio value. a company achieves the maximum possible rate of return equal to 22.5%. As one of the main goals of our research was to contribute to prior research by a deep industry-specific analysis, we used data from each of the sampled industries in equation (3).

Table 7. Defining the optimal values and intervals of the current ratio of different industries

Industry	Polynomial trend	The highest CR	The highest RNOA	Average RNOA	To attain the highest RNOA the CR should be the following
General sample	RNOA = -2.199xCR^2 + 13.754xCR + 0.999	3.127	22.50	18.18	1.726 ≤ CR ≤ 3.127
Production	RNOA = -2.440xCR^2 + 14.048xCR + 1.570	2.878	21.79	17.82	1.604 ≤ CR ≤ 2.878
Services	RNOA = -1.707xCR^2 + 12.886xCR + 2.394	3.414	26.72	18.53	1.585 ≤ CR ≤ 3.414
Oil and gas	RNOA = -9.349xCR^2 + 36.389xCR - 17.948	1.946	17.46	15.22	1.457 ≤ CR ≤ 1.946
Metallurgy	RNOA = -2.549xCR^2 + 16.361x CR- 3.098	3.209	23.16	19.91	2.081 ≤ CR ≤ 3.209
Mechanical engineering	RNOA = -0.931xCR^2 + 6.8539xCR + 7.952	3.681	20.57	16.84	1.681 ≤ CR ≤ 3.681
Chemical and petrochemical	RNOA = -1.846xCR^2 + 14.062xCR - 4.129	3.810	22.66	15.04	1.778 ≤ CR ≤ 3.810
Electric power industry	RNOA = -1.291xCR^2 + 9.5436xCR + 9.560	3.695	27.19	22.12	1.714 ≤ CR ≤ 3.695
Transport	RNOA = -1.218xCR^2 + 4.921xCR - 4.696	2.133	26.54	20.13	1.484 ≤ CR ≤ 2.133

According to the world business practice, the recommended value of the current ratio is the interval from 1 to 2. However, in the given research we calculated realistic and current optimum intervals of the current ratio for Russia. The calculation was made based on the following assumption: the recommended interval of the current ratio is an interval of the current ratio within which a company's rate of return is higher than the average rate of return in a given economic sector; at the same time, this interval is below the value of the current ratio at which the relation between liquidity and rate of return becomes inverse. Thus, when the given values of the current ratio are exceeded. the relation between rate of return and liquidity becomes inverse; therefore it is unprofitable for companies to increase their current ratio above the values specified in Table 7.

Furthermore, as done by Volkov and Nikulin (2012), we decided to make one-factor regression models of the relation between a company's cash conversion cycle (CCC) and liquidity (expressed through the current ratio (CR). The following formula was used:

$$CR_{it} = \theta_0 + \theta_1 \times CCC_{it} + \xi_{it}, \quad (4)$$

where θ_j is a parameter before a quantitative variable; j(0; 1); ξ_{it} is the random component of the model; i = 1…..90; t = 2001…..2012; the index t corresponds to the observation periods, while the index i reflects the observations for each period.

An analysis of the one-factor regression models showed that liquidity and cash conversion cycle have a positive relation. Thus, with the help of the identified dependences we can also calculate the optimum intervals for the values of the cash conversion cycle (Table 8) based on the defined optimum level of liquidity:

Table 8. The optimum intervals of the cash conversion cycle determined on the basis of the defined optimum level of liquidity

Economic sector	Equation	Interval of CR (current ratio)	Interval of CCC (cash conversion cycle)	Value of CR when CCC = 0
General sample	CR = 0.0160xCCC + 1.996	(1.726; 3.127)	(-14.98; 74.95)	1.996
Production	CR = 0.0147xCCC + 1.723	(1.604; 2.878)	(-8.07; 78.60)	1.723
Services	CR = 0.0185xCCC + 1.999	(1.585; 3.414)	(-21.39; 47.48)	1.999
Oil and gas	CR = 0.0167xCCC + 1.991	(1.798; 3.162)	(-11.53; 70.14)	1.991
Metallurgy	CR = 0.0125xCCC +1.314	(1.240; 1.794)	(-5.88; 38.44)	1.314
Mechanical engineering	CR = 0.0138xCCC + 1.609	(1.457; 1.946)	(-11.08; 24.36)	1.609
Chemical and petrochemical	CR = 0.0135xCCC + 2.153	(2.081; 3.209)	(-5.33; 78.23)	2.153
Electric power industry	CR = 0.0193xCCC + 2.112	(1.681; 3.681)	(-22.34; 81.29)	2.112
Transport	CR = 0.0296xCCC + 2.143	(1.778; 3.810)	(-12.34; 56.31)	2.143
Telecommunications	CR = 0.0255xCCC + 2.127	(1.714; 3.695)	(-16.18; 61.50)	2.127
Trade	CR = 0.0110xCCC + 1.881	(1.484; 2.133)	(-36.05; 22.95)	1.881

It is clear that every company has its own 'unique' level of liquidity and therefore its own value for the cash conversion cycle. However, if the cash conversion cycle of a company engaged in a given economic sector falls within the interval of optimum values calculated for this economic sector, we may say that such a company is more likely to ensure timely discharge of its current liabilities.

The type of working capital management policy (conservative, moderate and aggressive) implemented by a company depends on the targeted relationship between return on assets and liquidity. To classify these policy types we may also use the indicator of a company's cash conversion cycle. It is reasonable that we take the calculated recommended values of the cash conversion cycle as a basis; those which were obtained with the help of the regression equations and which establish a defined relationship between companies' cash conversion cycles and current ratio (the given values are presented in Table 8). We think that if a company's cash conversion cycle is found within the calculated intervals, a company follows a moderate policy of working capital management. This because it maintains such a volume of working capital that it is possible to ensure an optimum level of liquidity. If the value of the cash conversion cycle is below the lower limit of the calculated optimum interval, a company implements an aggressive policy of working capital management and risks losing liquid assets due to a possible shortage of working capital. If the value of the cash conversion cycle exceeds the upper limit of the calculated optimum interval, a company carries out a conservative policy of working capital management, i.e. it maintains an excessive level of working capital.

Conclusions

In this research we analyzed the influence of liquidity and cash conversion cycle on the return ratio of Russian companies. The growth of a company's return on assets is primarily restricted by the need to ensure a required level of liquidity and an optimum value of the cash conversion cycle (it is different for each organization).

We identified in all the sampled companies (except for the subsample of enterprises with a negative cash conversion cycle), a statistically significant inverse relation between cash conversion cycle and rate of return; regarding the subsample of enterprises with a negative cash conversion cycle. The given relation turned out to be direct. The aforementioned result allowed us to conclude that in order to improve its rate of return. a company should seek to achieve a zero cash conversion cycle value. Looking at all the subsamples of companies, we also revealed a statistically significant direct relation between a company's current ratio and rate of return.

On calculating the optimum values of the cash conversion cycle, we studied the dependence of the cash conversion cycle on a company's current ratio. We revealed a statistically significant direct relation between the given indicators. In this case, regression analysis makes it possible to determine the required value of the cash conversion cycle based on the given liquidity level of a company.

Based on a theoretical analysis and an empirical study we have found that in order to ensure an increase in the return on assets, companies should bring the value of their cash conversion cycle into accordance with the recommended current ratio. Adjustment of a cash conversion cycle and of a current ratio presupposes that appropriate management decisions should be made regarding working capital elements − these are taken into account when calculating a company's cash conversion cycle, current assets and current liabilities; current assets and current liabilities are considered when calculating the current ratio.

Thus, to reach the maximum possible rate of return, an enterprise should manage the value of its cash conversion cycle appropriately and retain a defined

but optimum level of liquidity (the current ratio). In other words, a company may determine its own specific target values for the cash conversion cycle and current ratio. In this case it is desirable that the target values of the cash conversion cycle should fall within the recommended intervals of values for the defined indicator for different industries which are determined by the current ratio.

We present several new results which contribute to the existing literature by testing the relationship between cash conversion cycle, current liquidity and return on net operating asset for the emerging Russian market. The results also have several implications for the managers of the Russian companies within the different industries for whom we have developed the optimum intervals of cash conversion cycle and current liquidity ratio. When evaluating their investment decisions for excess cash, boards of directors and managers can evaluate the amount of cash reserves and their payout policies and, finally, how to vary them according to different market conditions (bull or bear). In addition, the results can be useful for analysts; be more aware when valuating high capital expenditure companies.

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Appendix

Table 3. Descriptive statistics of whole sample and subsample variables

Variable	RNOA (Return on net operating assets)				CCC (Cash conversion cycle)				CR (Current ratio)				LOGTA (Logarithm of Total Assets)			
Unit of measurement	Percentage, %				Days				-				-			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Total sample	18.18	19.80	-64.08	112.99	44.42	45.40	-189.05	189.24	1.978	1.795	0.337	11.910	9.00	0.99	4.94	12.62
Production companies	17.82	19.04	-63.09	112.99	58.3	58.81	-86.40	189.24	1.926	1.745	0.391	10.070	9.17	0.91	6.35	12.32
Services	18.53	20.44	-64.08	85.19	30.53	49.63	-189.05	95.13	1.981	1.844	0.337	11.910	8.84	1.03	4.94	12.62
Oil and gas	21.11	20.24	-55.72	85.97	44.49	55.73	-60.68	132.21	1.992	1.221	0.391	6.246	9.58	0.88	7.46	12.32
Metallurgy	15.04	16.55	-63.09	81.33	52.83	52.72	-70.60	176.95	1.850	2.068	0.596	7.470	9.16	1.23	6.46	11.68
Mechanical engineering	15.22	14.76	-52.65	58.82	67.83	58.74	-62.01	189.24	1.850	0.828	0.655	4.346	8.98	0.64	7.79	10.93
Chemical and petrochemical	19.91	15.75	-19.40	112.99	68.06	58.30	-86.40	167.45	2.190	1.856	0.572	10.070	9.18	0.81	7.26	11.65
Electric power	16.84	16.47	-45.8	70.15	24.86	55.86	-142.30	82.48	1.846	1.292	0.382	8.052	9.09	0.98	7.42	11.36
Transport	15.04	14.80	-26.72	73.04	39.91	52.51	-80.02	87.62	2.414	2.104	0.419	10.006	9.13	0.91	7.54	12.62
Telecommunication	20.13	18.53	-64.08	85.19	12.92	37.81	-189.05	73.42	1.873	2.023	0.338	11.910	8.45	1.30	5.35	11.69
Trade	22.12	14.73	-62.01	71.79	42.54	52.47	-29.29	95.13	2.091	0.498	0.546	2.931	9.01	0.53	7.93	10.72