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Evaluating net investments in the operating working capital under certainty: the integrated approach to working capital management

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In day-to-day operations managers decide on a variety of working capital variables influencing the size of operating cash flows its timing and risk and therefore the firm's value. This paper reveals the tool based on NPV criterion appropriate for evaluation of net effect the changes in working capital management have on the firm's value. This research merge previous work on the applications of the NPV criterion in the field of working capital management within discounted cash flows framework (Lieber and Orgler, 1975; Sartoris and Hill, 1983; Kim and Chung, 1990; Arcelus and Srinivasan, 1993) and contributes to it by (i) including additional working capital decision variables: advance payments, labor costs and deferral of salaries payments, (ii) focusing on moments of outflows instead of moments of costs arising and (iii) it is designed to be applicable for discretionary type of business activity. As being value-based tool presented here is superior to well established financial ratios analysis usually suggested for assessing the efficiency of working capital management.

JEL Classifications: G31, D92

Keywords: Working capital management, NPV criterion, cash flows framework

Introduction

In the short term financial management managers decide on operating working capital, OWC,: its size, structure and sources of financing. This easy looking decision problem boils down however in practice into a variety of decision variables like: trade credit terms both granted and received, discount rate, prices: sale, materials, labor and inventory carrying and shipping, the delay of salaries payments, penalty charges for late payments, rate on overdue payment from collection agency and time the company decides on selling overdue balances, limits of materials consumption, ordering cycle, delivery batch and delivery cycle and operating assets reserves are so far the most common. When managers decide on one variable without changing the remaining, the evaluation of the financial results, i.e. changes in the firm value, seems not to be a hard task. However, this situation occurs rarely. Usually change in one variable alters the remaining: for example increasing the discount rate may increase the sale and simultaneously requirements for inventory both materials and finished goods, so the batch or the delivery cycle will change. More often managers must simultaneously decide on more than one variable which influence the firm's value in a mixed manner and the net result of such changes is hard to evaluate.

So the question appears: how to evaluate changes in OWC management policy in line with wealth maximization criterion? Based on well-established financial theory in the field of capital budgeting, it is hypothesized in this paper that relevant for such evaluation is NPV criterion. However, the NPV criterion requires the cash flows workshop not the accrual accounting. Therefore, the perception of investments in OWC is moved from traditional

balance sheet to cash flows workshop, particularly NPV is applied to operating cash flows as generated by operating cycle. NPV may be appropriate criterion for decision making, thus it is consistent with wealth maximization criterion, occurs efficient while evaluating investments in OWC over the entire planning horizon and captures the integrative nature of the working capital management. The goal of this paper is to design the decision criterion based on NPV that enables managers to take a decisions in the field of OWC management that is consistent with wealth maximization criterion.

This paper merges previous work on the applications of the NPV criterion in the field of working capital management within discounted cash flows framework (Lieber and Orgler, 1975; Sartoris and Hill, 1983; Kim and Chung, 1990; Arcelus and Srinivasan, 1993) and contributes to it by (i) including additional working capital decision variables: advance payments, labor costs and deferral of salaries payments and (ii) focusing on moments of outflows instead of moments of costs arising. Moreover, (iii) it is designed to be applicable for discretionary type of business activity. The model developed in this paper may help managers during contract negotiations as well as serve as a tool for improving efficiency of working capital management. It enables evaluation of cash flows forecasts from financial perspective and therefore its application may help managers to increase firm value.

The outline of the paper is as follows. The next part gives a brief literature review on both: integrating approach to working capital management and application of NPV criterion for decision making purposes. There is a short note about traditional vein as presented in textbooks. The following part develops model for simplicity purposes and it is divided into two sections: first presents the basic version of the model enabling for clear explanation of the idea employed in it and the second section presents the full version of the model which is far more complicated. Then a case study describes the application of the model in producing company focusing on details required to use it. Finally, ending part consist of conclusions and signs for future research.

Literature review

After the extended period of compartmentalization of working capital management relevant to its components (operating cash, accounts receivable, inventories and operating current liabilities (accounts payable and accruals)), working capital management most recently is viewed from the integrated perspective[1]. It happens due to obvious connections between each of these components lasting in fact in a strict relationship: they all are simultaneously employed in the company operating cycle. Moreover, in light of Goldratt's theory of constrains it is justified to argue that it is incorrect to consider management of OWC separately due to its components even though optimization for each component is connected with one homogenous for entire company goal function.

The traditional decision criterion in the field of working capital management was based on cost minimization (e.g., Miller and Orr, 1969; Merville and Tavis, 1973). However, as the financial theories developed and started to operate in the cash flows the traditional cost minimization criterion appears as less effective to profit maximization (Kim and Chung, 1990). It occurs mainly due to the fact that working capital management highly influences demand for the product, abolishing in this way the main assumption under which cost minimization and net income maximization criterions are equivalent. In the wealth maximization stream the integration of working capital management starts from accounts receivable management which includes a lot of decision variables (Schiff and Lieber, 1974; Lieber and Orgler, 1975) then moves to inventory and accounts receivable integration (Kim and Chung, 1990), and finally integrate all working capital components (Sartoris and

[1] However, the later approach still dominates in the text-book literature [like Brigham, Ehrhart 2008] while the former dominates in journal papers (like Hill, Kelly, and Highfield, 2010; Kieschnick, Laplante, and Moussawi, 2013)

Hill, 1983, Arcelus and Srinivasan, 1993). Foundation papers of Schiff and Lieber (1974), Lieber and Orgler (1975) base the decision rule on NPV criterion applied to profit: opposite to Kim and Atkins (1978) which move the considerations into the discounted cash flow framework. Following Kim and Atkins (1978) the considerations on working capital management have been embedded in the discounted cash flow framework. Apart from all these papers which analyze the working capital management decisions under certainty, most recently working capital management entered the field of decisions under uncertainty, particularly a contingent claims approach (Lam and Chen, 1986; Chung, 1990).

The traditional tools usually recommended to solve the decision problems within working capital management are financial ratios calculated on the basis of accrual accounting variables as presented in the balance sheet and income statement. These ratios may be divided into three groups: (1) first may help answer to the question how much the company has invested in the working capital, (2) second group indicates for how long company has invested its funds in the working capital, and (3) third group identifies what are the sources of financing investment in working capital. Ratios from the first group primary describes the size and structure of working capital as presented in the literature from the middle of previous century (see e.g., Collins, 1946; Muller, 1953). This approach developed during the following period to the concept of net operating working capital (Brigham and Erghart, 2008). Ratios from the second group refer to the concept of operating cycle and financing cycle introduced by Gitman (1974) and operationalized within financial statements by Richards and Laughlin (1980) into the concept of Cash Conversion Cycle (CCC). CCC indicates for how long company has invested its funds in one typical operating cycle. So far CCC is considered by many (e.g., Shin and Soenen, 1998; Deloof, 2003) to be the one measure showing the efficiency of working capital management: the shorter CCC is the more efficient is the working capital management. However, the last paper of Banos-Caballero, Garcia-Teruel, and Martinez-Solano (2014) reviles empirical evidences for nonlinear association between working capital management efficiency as measured by CCC and firm profitability. The concept of CCC was extended by Gentry, Vaidyanathan, and Lee (1990) to the ratio of Weighted Cash Conversion Cycle (WCCC) designed to show that two companies with the same CCC but different structure of working capital have different levels of liquidity, namely the one with more investments in less liquid assets like inventories has higher WCCC. As being fairly complicated in calculations this WCCC ratio has never been popularized. However, it is important to notice that the paper of Gentry, Vaidyanathan, and Lee (1990) was the first attempt to merge size and timing of operating cash flows altered by working capital management in one measure based on data available from financial statements. The third group concentrates on the right side of balance sheet and indicates the sources of financing investments in working capital. Among typical financial ratios showing the structure of liabilities outstanding is a concept of Net Liquid Balance (NLB) introduced by Shulman and Cox (1985), showing that the sources of financing working capital requirements (inventories + accounts receivable - operating current liabilities) split into fixed capital (primary equity) and the non-operating current liabilities (primary short term debt) diminished by liquid financial assets (primary short term investments).

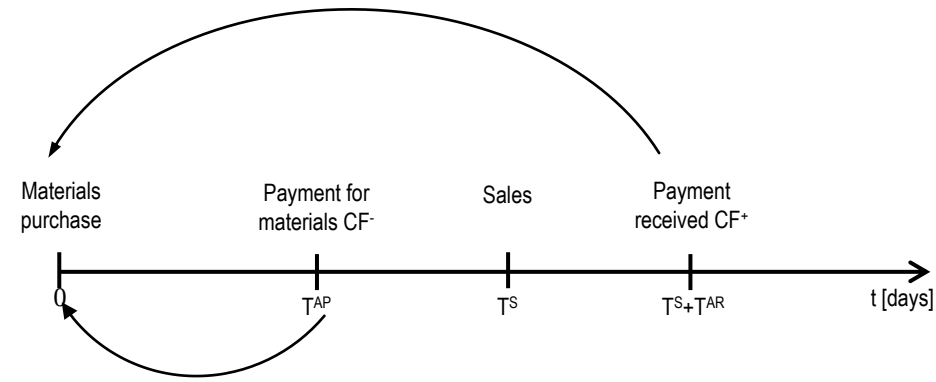
Financial ratio analysis of financial statement is basically ex post analysis and when applied ex ante needs pro forma statements being unfortunately of little accuracy. Contrary to it applying NPV within cash flows framework to working capital management gives it links to value creativity and merges size, timing and risk of cash flows in one measure, being therefore superior to traditional financial ratios analysis.

The model: Basic version

The model developed in this section is more general to model of Sartoris and Hill (1983) and thus has more pragmatic meaning for managers and students; because it easily

captures the core idea employed for decision making purpose. Let's assume that the company has only two decision variables: credit term granted T^{AR} and credit term received T^{AP}. Company operating cycle consists of purchasing - production - sales - collection and is partially spontaneously financed by accounts payable. Cash flows associated with this operating and financing cycle are operating cash inflows CF^{+} and operating cash outflows CF^{-} (see Figure 1). Both cash flows CF^{+} and CF^{-} appear at the end of the trade credits periods T^{AR} and T^{AP} respectively, as it is not economically justified to settle accounts earlier for customers or company. Model assumes continuous flows resulting from sales what means that such timeline starts every day of company operations.

FIGURE 1. THE CASH FLOWS TIMELINE



Constant credit sales

Assuming that the sales is known with certainty and constant over the whole planning horizon T, cash flows for any operating cycle follow the same pattern described by timing and magnitude of cash flows. Timing is defined by working capital policy parameters (T^{AR} and T^{AP})and as a result of constant credit sales cash flows CF^{+} and CF^{-} magnitude does not change over the whole planning horizon. As cash flows pattern does not change it is enough in this case to evaluate investment in one typical operating cycle. The net present value NPV of cash flows associated with this typical operating cycle equals to:

$$NPV = -\frac{CF^{-}_{T^{AP}}}{(1+r)^{T^{AP}}} + \frac{CF^{+}_{T^{S}+T^{AR}}}{(1+r)^{T^{S}+T^{AR}}}, \tag{1.1}$$

where: r - risk free rate (under the conditions of certainty), T^{S} - time of sales.

Changes in the working capital policy parameters from T^{AR} and T^{AP} to $T^{AR'}$ and $T^{AP'}$ should be accepted only when new NPV' exceeds the previous NPV:

$$NPV' - NPV > 0, \tag{1.2}$$

Discretionary time pattern of credit sales

As sales rarely is constant over the planning horizon T in practice, it is more realistic to assume that sales follow a time pattern *CS(t)*. It can be time pattern of any type including

seasonal variations and, moreover, sales pattern is freely to change over time. As our considerations refer to certainty, we still assume sales time pattern and its possible changes are known with certainty. Additionally, cash flows CF^+ and CF^- are functions of sales and follow sales time series pattern, therefore cash flows are functions of time $CF^+(t)$ and $CF^-(t)$. Timing of cash flows results from T^{AP} and T^{AR}. So finally cash flows pattern properties are generated from both: working capital policy parameters T^{AP} and T^{AR} and sales time pattern. As each operating cycle cash flows may differ only due to sales time pattern and its changes we need to include in such case all cash flows generated from sales to evaluate investments in working capital over the whole planning horizon T. Introducing for more convenience the continuous discounting, first we calculate the NPV_t representing the net present value of cash flows for each operating cycle beginning at t:

$$NPV_t = -CF(t)^- \cdot e^{-rT^{AP}} + CF(t)^+ \cdot e^{-r(T^S + T^{AR})}, \tag{1.3}$$

Then, we calculate the NPV of the whole project - investment in the working capital over the entire planning horizon T:

$$NPV = \int_0^T \left| (NPV_t = -CF(t)^- \cdot e^{-rT^{AP}} + CF(t)^+ \cdot e^{-r(T^S + T^{AR})}) \cdot e^{-rt} \right| dt = \int_0^T \left| NPV_t \cdot e^{-rt} \right| dt, \tag{1.4}$$

Changes in working capital policy parameters from T^{AR} and T^{AP} to $T^{AR'}$ and $T^{AP'}$ are acceptable only if condition 1.2 holds.

The model: Extended version

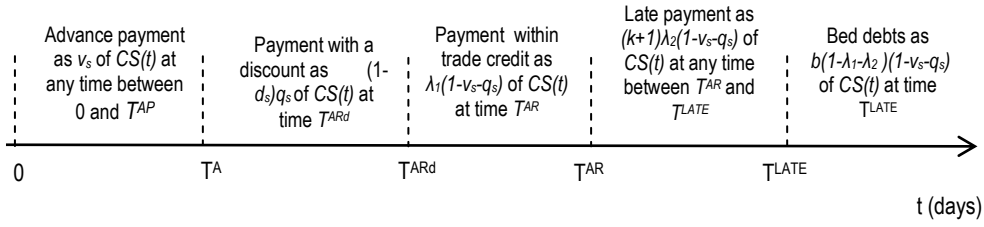
The model developed in this section origins in the papers of Lieber and Orgler (1975), Sartoris and Hill (1983), Kim and Chung (1990), Arcelus and Srinivasan (1993). The first paper considers only account receivable management and includes working capital policy parameters like: discount for early payments, trade credit, late payments and bed debts. Model presented in the second paper includes only discount rate and trade credits terms as a parameters of working capital management. Model presented in the third paper extends the second model of Sartoris and Hill (1983) by bed debts and finished goods inventory policy: particularly a batch of sales. It is not clear, however, why cash outflows are assumed by Kim and Chung (1990) to appear continuously during an operating cycle letting though the trade credit received from suppliers to be excluded from the working capital management. The last model, being so far the most extended, however excludes the possibility of late payments and is devoted for wholesalers. The model developed in this paper is intended to include all mentioned working capital policy parameters, focuses on moments of outflows instead of moments of costs arising and be applicable for discretionary type of business activity. For simplicity the model will be divided into cash inflows part and cash outflows part.

Cash inflow from one operating cycle

Cash inflow timeline may complicate (see Figure 2) by introducing apart from trade credit period T^{AR} the additional working capital policy parameters: selling price p_s per unit of sales S(t), advance payment as a portion v_s of credit sale appearing at any time between the t=0 standing for the beginning of the operating cycle and t = T^{AP} standing as the end of trade credit period received from suppliers (advance payment are primary used for

purchase of materials for production), cash discount d_s, trade credit period with a discount T^{ARd}, penalty rate k for late payment appearing any time between the T^{AR} and T^{LATE}, and rate b relevant to portion of overdue balances received from collection agency at time T^{LATE} being the maximum time company tries to collect its balances.

FIGURE 2. CASH INFLOWS TIME LINE IN THE EXTENDED MODEL WHERE CS(t) IS A CREDIT SALE EQUALS TO $p_sS(t)$



Present value of cash inflow from one operating cycle equals to:

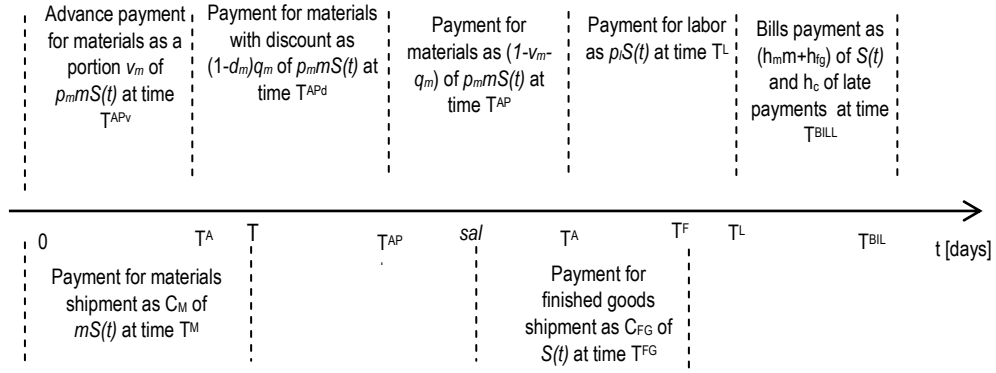
$$PV_t^{CF^+} = \int_0^{T^{AP}} \left| v_s p_s S(t)\cdot e^{-rt} \right| dt + (1-d_s)q_s p_s S(t)\cdot e^{-r(T^S+T^{ARd})} + \lambda_1(1-v_s-q_s)p_s S(t)\cdot e^{-r(T^S+T^{AR})} + \\ + \int_{T^{AR}}^{T^{LATE}} \left| (k+1)\lambda_2(1-v_s-q_s)p_s S(t)\cdot e^{-rt} \right| dt + b(1-\lambda_1-\lambda_2)(1-v_s-q_s)p_s S(t)\cdot e^{-rT^{LATE}}, \quad (1.5)$$

Where: v_s - portion of credit sales relevant to customers paying in advance; p_s - price per unit sale; $S(t)$ - sales time series following any time pattern; T^{AP} - trade credit period received from suppliers; d_s - discount rate for early payment; q_s - portion of credit sales relevant to customers using a cash discount; T^{ARd} - trade credit period relevant to discount for early payment; λ_1 - portion of credit sales relevant to customers paying on time within trade credit; T^{AR} - trade credit period granted by company; k - penalty rate for late payment; λ_2 - portion of credit sales relevant to customers paying late; T^{LATE} - the end of the operating cycle, maximum time period company collects its balances; b - portion of the overdue balances sold to collecting agency relevant to cash received.

Cash outflow from one operating cycle

Similarly to cash inflows timeline cash outflows timeline (see Figure 3) complicates somehow if we introduce apart from trade credit received from suppliers T^{AP} additional working capital policy decision variables: price for unit of materials p_m used in production of S(t) units, materials consumption m relevant to requirements for materials, advance payment made for suppliers at time T^{APv}, usage of the discount d_m offered by suppliers paid at time T^{APd} of trade credit, units costs of labor l paid at T^L and h_m and h_s as the carrying inventory costs of materials and finish goods respectively and h_c as costs of collecting overdue balances - all paid at T^{BILL}, C_M and C_{FG} as shipment costs of materials and finished goods respectively paid at T^M and T^{FG}. Conversely however to cash inflows cash outflows occur at defined fixed time.

FIGURE 3. CASH INFLOWS TIME LINE IN THE EXTENDED MODEL WHERE CS(t) IS A CREDIT SALE EQUALS TO $p_sS(t)$



Present value of cash outflows from one operating cycle equals to:

$$PV_t^{CF^-} = v_m p_m mS(t)\cdot e^{-rT^{APv}} + (1-d_m)q_m p_m mS(t)\cdot e^{-rT^{APd}} + (1-v_m-q_m)p_m mS(t)\cdot e^{-rT^{AP}} + \\ + p_l S(t)\cdot e^{-rT^L} + \left[h_m m + h_{fg} + h_c\lambda_2 p_s(1-v_s-q_s)\right]S(t)\cdot e^{-rT^{BILL}} + C_M mS(t)\cdot e^{-rT^M} + \\ + C_{FG}S(t)\cdot e^{-rT^{FG}} \qquad (1.6)$$

Where: v_m - portion of costs of production paid in advance; p_m - price per unit of materials; m - unit materials consumption; T^{APv} - time credit period for advances payment; d_m - discount for early payment received from suppliers; q_m - portion of production costs paid with a discount; T^{APd} - time credit period with discount; T^{AP} - time credit period received from suppliers; p_l - labor cost per unit; T^L - salaries deferral period; h_m - carrying costs for materials inventory as a rate; h_{fg} - carrying costs for finish goods inventory per unit; h_c - costs of collecting overdue balances as a rate; T^{BILL} - time of paying bills; C_m - delivery costs for materials as a rate; T^M - time credit period received for delivery of materials; C_{FG} - delivery costs for finished goods as a rate; T^{FG} - time credit period received for delivery of finished goods.

The model integration

The integration of A and B part of the model relies on merging present values of cash outflows and cash inflows calculated at time t according to 1.5 and 1.6. Time t now represents the beginning of the each operating cycle over the entire planning horizon, so that the net present value of all cash inflows and outflows at the beginning of the planning horizon equals:

$$NPV = \int_0^T \left|\left(-PV_t^{CF^-} + PV_t^{CF^+}\right)\cdot e^{-rt}\right| dt \qquad (1.7)$$

Changes in the working capital policy namely changes in the model parameters listed below 1.5 and 1.6 are acceptable if condition 1.2 holds.

A case study: Producing company

As an example of above model application a medium size privately held producing company has been chosen. Current company policy should be characterized as forced fit to all - company receivers and suppliers. Company products go mainly to large multiple retailers who do not negotiate but rather request and define terms of trade credit given by the company as well as selling price. Company suppliers operate on somehow hard dairy market spoiled particularly by common agricultural UE policy and emerging speculates induced by the last crisis all resulting in higher materials price volatility and its limited access. Working capital management in such circumstances involves: materials price, labor price, selling price - per unit, carrying costs and transport costs per bunch, trade credit terms received. Company managers consider changes in the OWC policy and the task is to evaluate this change and take a decision that adds value.

Model operationalization

Company products are not homogenous, so at the first trial one product is taken - melted cheese cube. Financial data as recorded by company are expressed somehow differently from those listed in the model (1.6 and 1.5), so some model modifications are needed. Particularly, all variable costs as recorded from invoices and salaries are unit costs. Available unit costs structure was estimated on the basis of costs injured in April 2014. Other available data gathered on a daily basis over period 2013-01-02 to 2014-05-16 include: daily sales to one retailer, its unit price, dates of issuing invoices to one retailer and corresponding dates of cash inflows from that retailer, dates of issuing materials invoices from all suppliers and corresponding dates of cash outflows and balance sheet at the end of 2013. The modification of the model presented in the previous section includes introducing of a costs structure and disbursement payment pattern build similarly to (Stone, 1976). The present value of daily sales at t therefore is:

$$NPV_t = p_s S(t) \cdot e^{-rT^{AR}} - \sum_{i=1}^{k} f_i^{\,m} \cdot p_m S(t) \cdot e^{-rT_i^{AP}} - \sum_{j=1}^{s} f_j^{\,a} \cdot p_a S(t) \cdot e^{-rT_j^{AP}} \quad (1.8)$$

,

Where: $S(t)$ - daily sales in kg; p_s - sales price per kg; T^{AR} - term of trade credit granted to retailer; p_m - materials costs per kg of sales; T^{AP} - term of trade credit received from suppliers; p_a - administrative costs per kg of sales; f^m_i - i-th portion of p_m paid at T_i^{AP}, f^a_j - j-th portion of p_a paid at T_j^{AP}, r - WACC as a daily rate.

The NPV over the entire planning horizon T comes directly from (1.4) and omitted in (1.8) present value of salaries:

$$NPV = \int_0^T \left| NPV_t \cdot e^{-rt} \right| dt - p_l S(t) \cdot e^{rT^L} \quad (1.9)$$

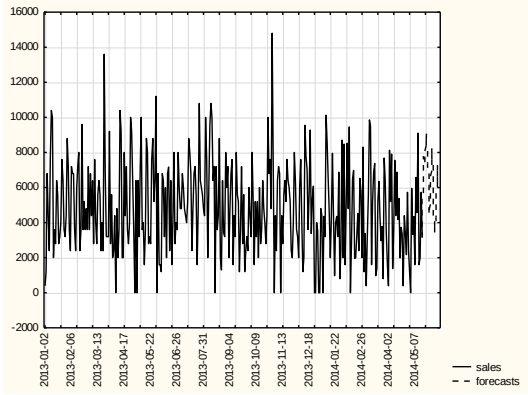
,

Where: NPV_t - net present value of cash flows connected with day t sales at day of sales t; T^L - salaries payment deferral period; p_l - salaries per kg of sales

Model estimation

The primary task is to prepare daily sales forecast. The daily sales over the period 2013-01-02 to 2014-05-16 are plotted on the Figure 4.

FIGURE 4. DAILY SALES OVER THE PERIOD 2013-01-02 TO 2014-05-16
AND SALES FORECASTS OVER THE 3 CONSECUTIVE WEEKS



To identify time series pattern the analysis of ACF and PACF function was employed. On the basis on the ACF and PACF patterns and portmanteau Q test of Box-Liung two systematic components of the time series were pointed: negative trend and weekly seasonal variations. After removal of these components by regression analysis with independent variables: *t* representing deterministic trend and *Q1, …, Q5* dummy variables representing weekly seasonal variations the ACF and PACF was again employed for residuals. As showing no significant effects, i.e. white noise, the model was assessed as being well specified: see below the for parameters estimations and basic regression statistics:

	Regression summary: logSt R= , 99796711 R^2= , 99593835 Adj.R2= ,99586625 F(6,338)=13813, p<0,0000 st. error: ,53903 Exclusion condition: v3=0 (day off)					
N=344	b*	SE of b*	b	SE of b	t(338)	p
Mon	0.4540	0.0044	8.4991	0.0817	104.09	0.0000
Tue	0.4304	0.0044	8.0577	0.0817	98.65	0.0000
Wed	0.4445	0.0044	8.3199	0.0817	101.81	0.0000
Thu	0.4720	0.0044	8.9012	0.0820	108.48	0.0000
Fri	0.4665	0.0044	8.7323	0.0827	105.65	0.0000
t	-0.0193	0.0069	-0.0008	0.0003	-2.80	0.0054

Source: Output from STATISTICA.

The rest of the inputs data to the model given by 1.8 was calculated as follows. The sales price per kg has shifted several times over the analyzed period. For the planning horizon the average price from the last 20 days was calculated and assumed to be 9.38 zl/kg for the future period. Next, the dates of cash inflows were analyzed. As credit term granted equals 60 days the real term differs a little from 57 to 63 days. Retailer pays only twice a week: currently on Tuesday and Thursday. The analyzes of dates of inflows show that invoices required on Sunday till Tuesday will be settled on Tuesday, while invoices required on Wednesday till Saturday will be settled on Thursday. Table 1 contains calculations of cash inflows based on sales forecast and dates of cash inflows from that sale.

TABLE 1. SALES AND DATE OF CASH INFLOWS FORECASTS

Day of sales	Day of week	Sales forecast [kg]	CF+ [zl]	Invoice credit term ending date	Day of week	Day of inflow	Credit term ending date	Trade credit term
2014-05-19	mon = 1	7783	73001.51	2014-07-18	6	5	2014-07-17	59
2014-05-20	tue = 2	7531	70638.03	2014-07-19	7	5	2014-07-17	58
2014-05-21	wed = 3	7359	69031.8	2014-07-20	1	3	2014-07-22	62
2014-05-22	thu =4	9060	84980.96	2014-07-21	2	3	2014-07-22	61
2014-05-23	fri = 5	7357	69008.12	2014-07-22	3	3	2014-07-22	60
2014-05-26	mon = 1	6422	60236.72	2014-07-25	6	5	2014-07-24	59
2014-05-27	tue = 2	4480	42020.14	2014-07-26	7	5	2014-07-24	58
2014-05-28	wed = 3	5245	49195.67	2014-07-27	1	3	2014-07-29	62
2014-05-29	thu =4	8212	77024.86	2014-07-28	2	3	2014-07-29	61
2014-05-30	fri = 5	6705	62891.79	2014-07-29	3	3	2014-07-29	60
2014-06-02	mon = 1	5369	50360.7	2014-08-01	6	5	2014-07-31	59
2014-06-03	tue = 2	3466	32507.96	2014-08-02	7	5	2014-07-31	58
2014-06-04	wed = 3	4303	40358	2014-08-03	1	3	2014-08-05	62
2014-06-05	thu =4	7291	68385.35	2014-08-04	2	3	2014-08-05	61
2014-06-06	fri = 5	6011	56382.25	2014-08-05	3	3	2014-08-05	60

Next, on the basis of purchasing invoices issuing dates, dates of corresponding cash outflows and type of costs identification, i.e. materials and administrative, the portions f^m_i and f^a_j were calculated and 2 payment patterns - one for materials and the other for administrative disbursements were built as in Stone (1972) approach (see Table 2).

TABLE 2. PAYMENT PATTERNS FOR MATERIALS AND ADMINISTRATIVE COSTS

Materials costs (outflows)		Administrative costs (outflows)	
Portions f^m_i	Payment deferral period	Portions f^a_j	Payment deferral period
0.03	21	0.02	cash
0.57	35	0.33	14
0.19	45	0.14	21
0.21	65	0.73	35
0.01	80	0.27	129

The unit costs equals 8.68 per kg and costs structure as given by the company was: 78% of units costs are materials costs, 11% are administrative costs and remaining 11% are salaries. The components of outflows forecasts are in the Table 3.

TABLE 3. CASH OUTFLOWS AND ITS COMPONENTS FORECASTS

Day of sales	Sales forecast [kg]	CF_t-	Materials	Administrative	Salaries [a)]
2014-05-19	7783	67584.77	52642	7549.197	68047.84
2014-05-20	7531	65396.66	50937.7	7304.786	25645.46
2014-05-21	7359	63909.61	49779.4	7138.683	
2014-05-22	9060	78675.34	61280.5	8788.01	
2014-05-23	7357	63887.68	49762.4	7136.234	
2014-05-26	6422	55767.13	43437.2	6229.171	
2014-05-27	4480	38902.23	30301.1	4345.366	
2014-05-28	5245	45545.33	35475.4	5087.399	
2014-05-29	8212	71309.58	55543.3	7965.257	
2014-05-30	6705	58225.2	45351.8	6503.736	
2014-06-02	5369	46623.91	36315.5	5207.876	
2014-06-03	3466	30095.85	23441.8	3361.697	
2014-06-04	4303	37363.42	29102.5	4173.482	
2014-06-05	7291	63311.12	49313.3	7071.832	

TABLE 3. CASH OUTFLOWS AND ITS COMPONENTS FORECASTS

Day of sales	Sales forecast [kg]	CF_t-	Materials	Administrative	Salaries [a)]
2014-06-06	6011	52198.67	40657.7	5830.574	

Note: [a)] Salaries are paid on monthly basis as we have May and Jun first part will be settled on the 10-th of July, while the second of the 10-th of July.

Merging information from the Tables 1, 2 and 3 and having WACC as a daily rate (0.02%) the present value of each cash flow was calculated - firs at the date of sales and second prior to the beginning of planning period (see Table 4).

TABLE 4. PRESENT VALUES OF CASH FLOWS, NPV OF EACH DAILY SALES AND NPV FOR WHOLE PROJECT

Day of sales	CFt+ [zl]	PVt(CF+)	CFt-[zl]	PVt(mat.)	PVt(adm.)	PVt(salary)[a)]	NPVt
2014-05-19	73001.51	18722.80	67584.77	20209.86221	5172.1601	26433.01	-6659.22
2014-05-20	70638.03	18539.33	65396.66	19555.55247	5004.7075	4987.169	-6020.93
2014-05-21	69031.8	16521.12	63909.61	19110.88057	4890.9059		-7480.67
2014-05-22	84980.96	20812.68	78675.34	23526.27227	6020.9043		-8734.49
2014-05-23	69008.12	17295.09	63887.68	19104.32344	4889.2278		-6698.46
2014-05-26	60236.72	15449.00	55767.13	16676.0362	4267.7742		-5494.81
2014-05-27	42020.14	11028.41	38902.23	11632.92576	2977.1284		-3581.65
2014-05-28	49195.67	11773.81	45545.33	13619.41209	3485.5151		-5331.12
2014-05-29	77024.86	18864.16	71309.58	21323.69107	5457.2141		-7916.75
2014-05-30	62891.79	15762.20	58225.2	17411.07043	4455.8861		-6104.76
2014-06-02	50360.7	12916.08	46623.91	13941.94016	3568.0573		-4593.92
2014-06-03	32507.96	8531.88	30095.85	8999.557494	2303.19		-2770.86
2014-06-04	40358	9658.73	37363.42	11172.77747	2859.366		-4373.42
2014-06-05	68385.35	16748.25	63311.12	18931.91462	4845.1045		-7028.77
2014-06-06	56382.25	14130.75	52198.67	15608.95836	3994.6849		-5472.89
EBIT = 67 227.36 zl				NPV = -106 004.30 zl			

Note: [a)] Present value of salaries expenditures was already calculated at period prior to t = 1 and included in calculations of NPV (according to 1.9).

Company managers consider negotiations with materials suppliers concerning lengthening the length of trade credit period. Such change will unfortunately increases the costs about 3%. New and old payments pattern are in Table 5.

TABLE 5. PAYMENT PATTERNS UNDER CURRENTLY AND NEW OWC MANAGEMENT POLICY

Currently applied OWC policy		New OWC management policy	
Portions f^m_j	Payment deferral period	Portions f^a_j	Payment deferral period
0.03	21	0	21
0.57	35	0	35
0.19	45	0.87	45
0.21	65	0.21	65
0.01	80	0.01	80

Recalculating outflows forecasts CF- in accordance with the changes in payment pattern and the level of costs results in NPV of -96 494.24 zl. As condition NPV - NPV' > 0 holds managers should introduce new policy.

Conclusion

The goal of this paper was to design a decision criterion based on NPV that may serve as a tool for OWC management in line with wealth maximization criterion. Applying the concept presented here moves the traditional perception of working capital from financial statements to investment approach. NPV is applied to operating flows generated by operating cycle and captures the influence of OWC management decision variables on it. This case study, based on original data, emphases the advantages of this concept and proofs that it may be easily applied in practice.

A few important points should be stated in the summary. First, the model presented here is very flexible and applicable for discretionary patterns of sales as well as cash flows timeline patterns. Second, the approach taken in the paper, namely investment approach to working capital management. links it with the value related company objective. Applying the concept in practice enables managers to take decisions that add wealth being, therefore it becomes superior to traditional tools applied in the field of working capital management.

Although it doesn't value the investment in OWC itself, it gives at least some general opinion on it - like in the case when the NPV over the planning horizon is negative. Particularly, a few empirical works disclose that investments in OWC diminish firm's value (Kieschnick, Laplante, and Moussawi, 2013; Almeida and Eid, 2014) which, however, requires deeper theoretical consideration. Eventually, looking at the working capital from cash flows perspective changes the traditional view of working capital - from components of assets and liabilities to net cash flows and as a such should add value to the firm.

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