Grzegorz Michalski

BALANCES OF CASH AND THE FIRM VALUE

***Abstract**: Firms hold cash for a variety of different reasons. Generally, cash balances held in a firm can be called considered, precautionary, speculative, transaction, and intentional. The first reason is the result of management anxieties. Managers fear the negative part of the risk and hold cash to hedge against it. Second, cash balances are held to use chances that are created by the positive part of the risk equation. Next, cash balances are the result of the operating needs of the firm. In this article, we analyse the relation between these types of cash balances and risk. This article also contains propositions for marking levels of precautionary cash balances and speculative cash balances. Current models for determining cash management assign no minimum cash level, or their minimum cash level is based on the manager's intuition. The model presented in this paper avoids intuition and is based on calculation. Application of this proposition should help managers to make better decisions to maximize the value of their firms.*

***Key words**: demand for cash, cash balances, risk, uncertainty, real options, option value of money, short-term financial management, working capital management*

JEL: G 32, G 11, M 11, D 81, O 16, P 33, P 34

1 Introduction

Corporate cash management depends on demands for cash in a firm. The aim of cash management is such that limiting cash levels in the firm maximizes the owner´s wealth. Cash levels must be maintained so as to optimize the balance between costs of holding cash and the costs of insufficient cash. The type and the size of these costs are partly specific to the firm's financial strategy.

In addition, cash management influences firm's value, because its cash investment levels entail the rise of alternative costs, which are affected by net working capital levels. Both the rise and fall of net working capital levels require the balancing of future free cash flows, and in turn, result in firm's valuation changes.

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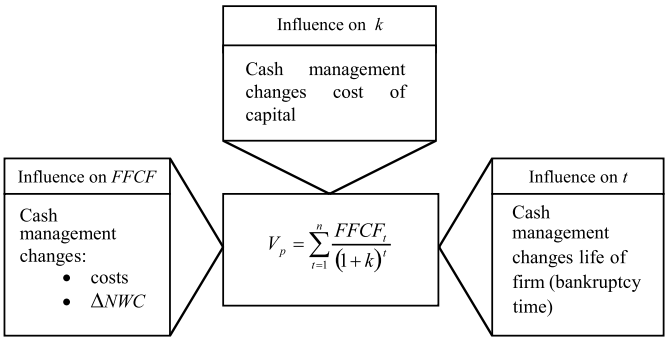
Figure 1

The Cash Level Influence on Firm's Value



Where: FFCF = Future Free Cash Flows; ΔNWC = Net Working Capital Growth; k = cost of the capital financing the firm; t = the lifetime of the firm and time to generate single FFCF.
Source: *own study.*

If the advantages of holding cash at a chosen level outweigh the influence of the alternative costs of holding cash, thereby increasing net working capital, then firm's value will also increase. The net working capital (current assets less current liabilities) results from lack of synchronization of the formal rising receipts and the real cash receipts from each sale. Net working capital also results from divergence during time of rising costs and time, from the real outflow of cash when a firm pays its accounts payable.

$$NWC = CA - CL = AAR + ZAP + G - AAP \tag{1}$$

Where: NWC = Net Working Capital, CA = Current Assets, CL = Current Liabilities, AAR = Average level of Accounts Receivable, ZAP = Inventory, G = Cash and Cash Equivalents, AAP = Average level of Accounts Payable.

When marking free cash flows, cash possession and increased net working capital is the direct result of amounts of cash allocated for investment in net working capital allocation. If an increase of net working capital is positive, then we allocate more money for net working capital purposes and thereby decrease future free cash flow. It is important to determine how changes in cash levels change a firm's value. Accordingly, we use an equation based on the premise that the firm's value is the sum of its discounted future free cash flows to the firm.

$$\Delta V_p = \sum_{t=1}^{n} \frac{\Delta FFCF_t}{(1+k)^t}, \tag{2}$$

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Where: ΔV_p *= Firm Value Growth,* $\Delta FFCF_t$ *= Future Free Cash Flow Growth in Period t,* k *= Discount Rate*[1].

Future free cash flow is calculated as:

$$FFCF_t = (CR_t - FC_{WD} - VC_t - Dep) \times (1 - T) + Dep - \Delta NWC_t - Capex_t \quad (3)$$

Where: CR_t *= Cash Revenues on Sales;* FC_{WD} *= Fixed Costs;* VC_t *= Variable Costs in Time t; Dep = Depreciation;* T *= Effective Tax Rate;* ΔNWC *= Net Working Capital Growth; Capex = Operational Investments Growth.*

Changes in precautionary cash levels affect the net working capital levels as well the level of operating costs of cash management in a firm. Companies invest in cash reserves for three basic reasons:

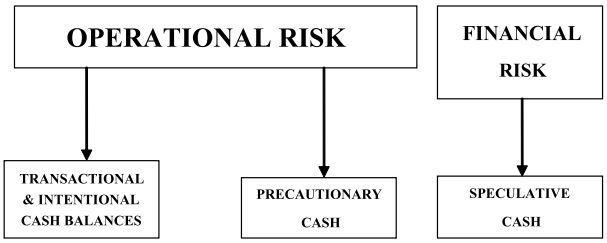
First, firms are guided by transaction and intentional motives resulting from the need to ensure sufficient capital to cover payments customarily made by the company. A firm retains transaction cash to ensure regular payments to vendors for its costs of materials and raw materials for production. Likewise, the firm retains intentional cash for tax, social insurance and other known non-transaction payment purposes.

Second, firms have precautionary motives to invest in cash reserves in order to protect themselves against the potential negative consequences of risk, which are unexpected, negative cash balances that can occur as a result of delays in accounts receivable collection or delays in receiving other expected monies.

Third, companies have speculative motives ([11], s. 417–418) to retain cash reserves. Speculative cash makes it possible for the firm to use the positive part of the risk[2] equation to its benefit. Companies hold speculative cash to retain the possibility of purchasing assets at exceptionally attractive prices.

Figure 2

Reasons for Holding Cash by Companies and Their Relation to the Risk



Source: *own study.*

[1] To estimate changes in cash management, we accept discount rate equal to the average weighed cost of capital (WACC). Such changes and their results are strategic and long term, although they refer to cash and short term area decisions [T.S. Maness 1998, s. 62–63].

[2] We define risk as the probability of obtaining a different effect than anticipated. Companies hold speculative cash to benefit from chance. Chance is the positive part of the risk equation, or the probability of obtaining an effect that is better than anticipated.

2 Transactional and Intentional Cash Management

For the purposes of this study, there are two approaches to determining intentional and transaction cash levels in a firm. First, to foresee intentional cash needs, we use ordinary predictors of such events, including the necessity of tax payments, social insurance etc. We also predict the need to perform obligations that result from investment purchases, or other intentional, earlier-known expenses. Second, transaction cash levels are determined by experience and expectations concerning transaction cash inflows and outflows. Cash outflows are often under the firm's control, but can also be hard to anticipate. With the knowledge of present and historical cash inflows and outflows, it is possible to notice that there are four basic situations referring to transaction operating cash flows in the company:

1. when future cash inflows and outflows may be anticipated, and inflows are expected to be greater than outflows;
2. when future cash inflows and outflows may be anticipated, and outflows are expected to be greater than inflows;
3. when future cash inflows and outflows may be anticipated, but neither is expected to be greater;
4. when future cash inflows and outflows may be anticipated.

Knowing the character and size of cash inflows and outflows, we can use one of the four models to determine management of cash levels. Of course, it is not necessary that only one situation occurs at all times within the firm; the same company can experience both the time when expected cash inflows are greater than outflows, and at another time it can experience periods when expected cash outflows are greater than inflows. This is similar to the predictability of future cash inflows and outflows. In the firm, there are periods when it is possible to foresee cash inflows and outflows; yet, there are other periods when predicting cash inflows and outflows may be very difficult or entirely impossible.

Using information about future cash inflows and outflows, we are able to apply, for example, the Baumol model or the Beranek model. If we anticipate that cash inflows are greater than outflows, we are able to use the Beranek model [4] also: ([13], pp. 131–132) to determine cash flow management within a firm. On the other hand, if we predict that cash outflows are greater than inflows we use the Baumol model [1]. When we cannot forecast long-term cash flows, for a period longer than approximately 14 days, we are able to use the Stone model [14], [11] to determine cash flow management. However, when we cannot predict future cash inflows and outflows at all, the Miller-Orr model [9] may be used to determine cash flow management.

3 Precautionary Cash Management − Safety Stock Approach

Current models for determining cash management, for example the Baumol, Beranek, Miller-Orr or Stone models, assign no minimum cash level, and their

minimum cash level is based on the manager's intuition. In addition, these models are inventory-based management models. In this study, we address the potential for adaptation of these methods of determining safety stock to determine minimum cash levels in the firm. Safety stock is a result of information about the risk of inventories. This model avoids intuition and is based on calculation. To calculate safety stock we use Equation 4 ([12], p. 57):

$$Z_b = \sqrt{-2 \times s^2 \times \ln \frac{C \times Q \times s \times v \times \sqrt{2\Pi}}{P \times K_{bz}}} \tag{4}$$

Where: z_b = Safety Stock, C = Cost of Inventories (in percentage); Q = One Order Quantity; v = Cost of Inventories (Price); P = Yearly Demand for Inventories; s = Standard Deviation of Inventory Spending; K_{bz} = Cost of Inventories Lack.

It is also possible to apply the following equation to determine minimum cash level [7]:

$$LCL = \sqrt{-2 \times s^2 \times \ln \frac{k \times G^* \times s \times \sqrt{2\Pi}}{P \times K_{bsp}}} \tag{5}$$

Where: LCL = Low Cash Level (Precautionary Cash Level); k = Cost of Capital; G^* = Average Size of One Cash Transfer[3] which are the basis of standard deviation calculation; P = the Sum of all Cash Inflows and Outflows in the Period; s = Standard Deviation of Daily Net Cash Inflows/Outflows; K_{bsp} = Cost of Shortage of Cash.

Part of the information necessary to determine *LCL* still requires the manager's intuition. For example, costs of shortage of cash contains not only costs known from accountant records, but also other costs, such as opportunity costs. Precautionary cash reserves are, first of all the result of anxieties about negative results of risk. Its measure is the standard deviation.

Example 1. Managers of the firm X, value the cost of the shortage of cash at 5000. The day's standard deviation of cash inflows/outflows is 35,466 monthly. Average single cash inflow/outflow is 27,250. The monthly sum all cash inflow/ outflow is: 817,477. The alternative cost of capital is 18%.

[3] In the Beranek model and the Baumol model, G* is twice optimal cash level. In the Stone and Miller-Orr models, the average transfer G* is assigned from real historical data or from its anticipation.

For the firm X, precautionary cash level is:

$$LCL_1 = \sqrt{-2 \times 35\,466^2 \times \ln \frac{\frac{0{,}18}{360} \times 27\,250 \times 35\,466 \times \sqrt{2\Pi}}{817\,477 \times 5\,000}} = 142\,961.42$$

When cash outflows and inflows volatility is 0, precautionary cash balance is also 0:

$$LCL_0 = 0$$

Then we can estimate net working capital growth:

$$\Delta NWC = LCL_1 - LCL_0 = 142\,961{,}42 = -\Delta CF_{t=0}$$

The standard deviation is 35,466 and tax rate is 20%. So, we can estimate yearly alternative cost precautionary cash reserves and the influence on the value of the firm:

$$\Delta TCC = \Delta NWC \times k = 142\,961.42 \times 0.18 = 25{,}733 = \frac{-\Delta CF_{t=1\ldots\infty}}{(1-T)}$$

$$\Delta V = \Delta CF_{t=0} + \frac{(\Delta CF_{t=1\ldots\infty}) \times (1-T)}{k} = -142{,}961.42 + \frac{-25{,}733 \times 0.8}{0.18} = -257{,}330$$

As demonstrated in order for the precautionary cash balance to remain level, with the standard deviation equal to 35,466; the result is a decrease in the firm's value of 257,330.

4 Speculative Cash Balance Management – Option Approach

Not all firms necessarily hold speculative cash balances. Speculative cash is held in order to utilize the positive part of the risk equation. Firms want to retain opportunities that result from price volatility. For example, in the ordinary practice of Polish firms, we see that speculative cash balances can be useful to benefit from transactions in foreign exchanges. It can be profitable for firms to purchase necessary products or services in foreign exchange at prices cheaper than their average purchase price. Such purchase is possible if the firm maintains speculative cash balances. Speculative cash balances enable the firm to use of their purchasing power any time. Such cash superiority over other assets shows option value of speculative cash balances [2][4].

[4] Cash may be compared to American option without *expiration date*. Other, near to cash assets can be compared to European option, see: ([5], pp. 5–6), and [2]. The right to faster acquisition has a value, and such value gives ground for holding speculative cash balances. Costs of expectation on realization of other options can cause loss that is not recovered by future earnings from these (less liquid than cash) assets, see: [2].

Example 2. The entrepreneur can choose from one of the following two possibilities:

- He can invest in the firm's activity, for example, he can purchase in foreign exchange,

or

- He can decide to hold cash (national currency).

Entrepreneurs make the decision between these two possibilities at least once a day. The purchase of foreign exchange and its use in the firm's operating activity makes other cash resources inaccessible for a continued speculation. If the entrepreneur chooses to hold cash, he still has the possibility to purchase foreign exchange. Yet, foreign exchange price changes from day to day. The daily standard deviation of the foreign exchange price is 4%. This means that the foreign exchange price today is 1.00 PLN. On the next day the foreign exchange price can be 1.04 PLN with the probability of 0.5; or 0.96 PLN with the probability of 0.5.

Suppose that next, the foreign exchange price meets its long-term value of 1.00 PLN. If on the first day, an entrepreneur decides to hold cash, and the next day's foreign exchange price falls to the level of 0.96 PLN (lower than its expected value), the entrepreneur's expected income will be 0.04 PLN. On the other hand, if the foreign exchange price reaches the level of 1.04 PLN (above its expected value), then the entrepreneur will not purchase foreign exchange, and his expected income will be 0 PLN. So, if the entrepreneur has cash for 10,000 foreign exchange units, his expected value of the benefit of holding in national currency (in cash) by one day, will be:

$$\mathrm{E(benefit)} = \sum_{i=1}^{n} \mathrm{benefit} \times p_i = \frac{0.04\mathrm{PLN} \times 10{,}000}{1.0005} \times 0.5 + 0\mathrm{PLN} \times 0.5 \approx 199.90 \text{ PLN}$$

The daily alternative cost of capital financing for the firm is:

$$\frac{18\%}{360} = 0.05\%$$

Therefore, we can also express it for 10,000 foreign exchange units:

$$0.05\% \times 10{,}000 = 5 \text{ PLN}.$$

This means that the expected benefit is 199.9 PLN. This demonstrates the basis for holding speculative cash balances in a firm. Of course, the size of speculative cash balances should be an effect of the firm's customary activities and its real operational needs. The legitimacy of holding speculative cash balances increases here together with the increase of volatility of foreign exchange pricing (or volatility of the price of any other assets necessary to the firm) and grows smaller together with the amount of the alternative costs of capital financing for the firm.

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5 Conclusions

Companies invest in cash reserves for three basic reasons: firstly, firms are guided by transaction and intentional motives; secondly, firms have precautionary motives to invest in cash reserves in order to protect themselves from the potential negative consequences of risk; thirdly, companies have speculative motives to retain cash reserves.

In this paper, we analyse the relation between these types of cash balances and risk. The present paper also contains propositions for marking levels of precautionary cash balances and speculative cash balances. Current models for determining cash management, for example the Baumol, Beranek, Miller-Orr or Stone models, assign no minimum cash level, or their minimum cash level is based on the manager's intuition. In addition, these models are based on inventory managements models. In this study, we address the potential for adaptation of these methods of determining safety stock to determine minimum cash levels in the firm. Safety stock is a result of information about the risk of inventories. This model avoids intuition and is based on calculation. Application of these propositions should help managers to make better decisions to maximize the value of their firms because such calculation could give better economic results than current firm's practice.

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