New Model of Current Account Balances

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SUMMARY

Managing current account balances – defining the value of the necessary closing level – is perhaps the most exciting daily routine activity of corporate financial managers. The relevant discussion of this subject in Corporate Finance by Brealey and Myers, one of the most popular manuals of today's higher education in finances, refers to research conducted over 60 years ago. This manual applies the Baumol model to current account balance management, starting from the costs of simple inventory management. An enhancement of the above is the Miller-Orr model, which restricts the volatility of the cash balances between an upper and the lower limit, and defines the value at one-third as the return point.

Our globalised world is characterized by electronic banking, which has fundamentally changed the entire system of finances. Research done on figures of the 2000s led to results that were different than before. According to new findings, in modern accelerated cash management the level of current account balances is not determined by the assumed "inventory management costs" (through the development of electronic methods, they have decreased drastically, anyhow), rather the habits of cash transaction management.

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INTRODUCTION

Two decades after finishing the university I met my former teacher, the famous theoretical physics professor István Lovas, at a conference. He started his presentation the following way: "I can see here some of my former students. First, I would like to apologize, because not long ago we realized that what I taught to them during their studies is no longer valid."

What was behind it? This is the nature of theoretical physics. This science usually develops like this: we collect experiences, then code them, build up a model, from which we draw logical consequences, decode them, and at the end we compare them to reality. And sometimes we realize our model was totally wrong. It happens because we build up the model based on some experiences of the past, and we are trying to provide explanations for many new experiences on the basis of this model.

As my beloved professor realized, the 1980s model of theoretical physics was wrong, as became obvious at the end of the century. As we know, this has happened many times, not only in physics but also in many other fields of science.

In economics, companies apply forward-looking cash-flow planning, thus ensuring an appropriate cash flow position. The disposable cash and cash equivalents generated in business operations are valuable for the companies, as these assets can be used to increase liquidity and accomplish more efficient cash management. In daily business operations the financial management of each company has to make decisions on the efficient management of disposable cash; whether the cash should be available on the current account in exchange for a low sight interest, or rather as a term deposit generating higher interests, taking into account that a deposit withdrawn before maturity will incur interest losses. An overdraft may be an appropriate solution for the balancing of the cash flow, which provides a constantly available source of financing for the company, in exchange for paying the relevant costs. How should we specify the optimal current account balance, one which generates the smallest loss and at the same time, the highest gain for business operations?

THE CLASSIC MODELS

It is a fundamental principle in economics that the company should have enough disposable cash for the marginal rate of return on liquidity to be equal to the value of lost interest income [Brealey and Myers 1998]. William Baumol was the first to point out sixty years ago that the simple inventory management model can be applied efficiently to corporate financial management as well [Baumol 1952]. The initial problem of the inventory management model is that the provision of the stock level

necessary for fulfilling customer needs incurs costs. High inventory level compared to demands means high inventory management costs, and on the other hand, ordering in small batches will increase the fixed costs of ordering. In inventory management businesses have to consider two types of expenditures: the financing costs embodied in the inventory and the ordering costs incurred by procurement. The more the company orders of the given product - thereby reducing the costs incurred related to the order - the higher the extent by which the size of capital employed in inventories increases. Therefore we should increase the number of orders, as long as the decrease of ordering costs is higher than the increase of financing costs, i.e. the liquidity loss caused by employed capital. The equilibrium point will be there where the two effects will precisely cancel each other out:

$$Q = \sqrt{\frac{2 \bullet \text{sales} \bullet \text{ordering costs}}{\text{financing costs}}}$$

Based on the research of Baumol, the results obtained from the simple inventory management model can be applied efficiently in the field of corporate cash management as well. In this case, the place of the inventory is taken by the cash and cash equivalents, which will keep decreasing through the payments, and the orders are substituted by the securities held by the company, the sale of which incurs loss of interest (financing cost), as well as administrative costs (ordering costs). In this case the formula of the simple inventory management model will be as follows:

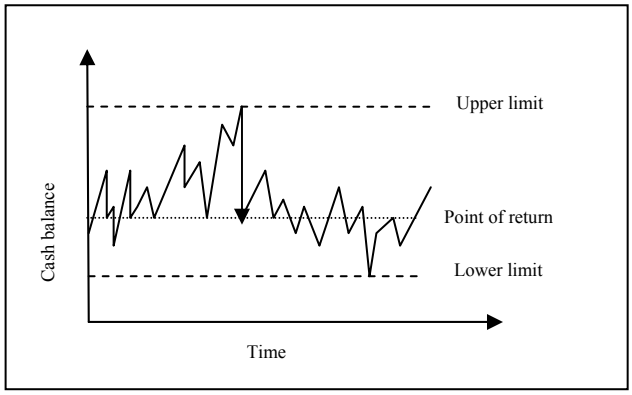
Sum of the securities of the company offered for sale =

$$= \sqrt{\frac{2 \bullet \text{annual payments} \bullet \text{administrative costs}}{\text{interest rate}}}$$

The value of the interest rate is in the denominator, thus it is easy to note the following relationship: higher interest rates reduce the amount of securities intended to be sold, since the higher the interest rate, the bigger loss the company has to accept as a result of the sale.

The model can be applied with very good results, as long as the company is utilizing its cash inventory evenly. At that time the payment turnover of the companies was already significant in terms of amounts, but in terms of transaction volume it was relatively low [Fogaras, 1997]. However, even this kind of cash management showed continuous volatility, thus it was difficult to plan for. So in such cases the Baumol model - derived from the simple inventory management model - can no longer be applied.

Miller and Orr attempted to find out how a company should manage its operations if it cannot forecast precisely the volatility of its daily cash flow [Miller and Orr 1966]. When planning cash flows, one of the biggest problems is the management of accounts receivable and accounts payable: money may be credited at any time from the payment of an invoice issued earlier, but the accounts payable should also be settled on an ongoing basis. Thus it requires careful planning to ensure that at any one time the appropriate level of cash should be available, while its level should be as low as possible, since excess cash will not generate income for the company. In their research Miller and Orr monitored the fluctuation of the cash inventory of companies and came to the following conclusion: cash shows constant fluctuation up to an upper limit. At this point the company is looking for a short-term type of investment for the placement of its disposable cash, thus the cash inventory returns to an optimal level, from which it will once again show constant fluctuation. Along with this reasoning, the balance will reach a lower limit at times, at which the company will release cash from term accounts (through the sale of securities or withdrawal of deposits before maturity) in order to bring its balance to the optimal level once again. Their results are shown in Figure 1.



Source: Based on Brealey and Myers (1998), p. 302

Figure 1: Fluctuation of cash balances (Miller and Orr)

Therefore, based on Miller and Orr's research, the cash inventory of the company may be constantly changing until it reaches one of the limits (upper or lower). At that point the financial manager will modify the balance by releasing cash or making term deposits. On the other hand, the question arises: for how long can a manager let the cash inventory keep changing?

When researching this issue, two important points were observed. One of the fundamental conclusions is that if the fluctuation of the balance is high at a daily level, or if the release of cash incurs high transaction costs, then it is recommended to maintain a wide leeway between the limits. In this case the company is able to save money by reducing its transactional costs.

The other important result of the model is the position of the point of return. In fact, after reaching one of the limits, the balance does not return to the middle of the distance between the two limits, but rather to a point closer to the lower limit. According to the research of Miller and Orr, companies usually reset their balances at a level corresponding to the lower third of the deviation. Based on the above the fluctuation reaches the lower limit more often than the upper one, i.e., the current account distribution is not symmetrical. But this does not minimize the number of transactions mentioned above, since we should return to that mid-point. However, at the mid-point the level of the cash inventory is higher than optimal, and therefore the company will generate interest loss.

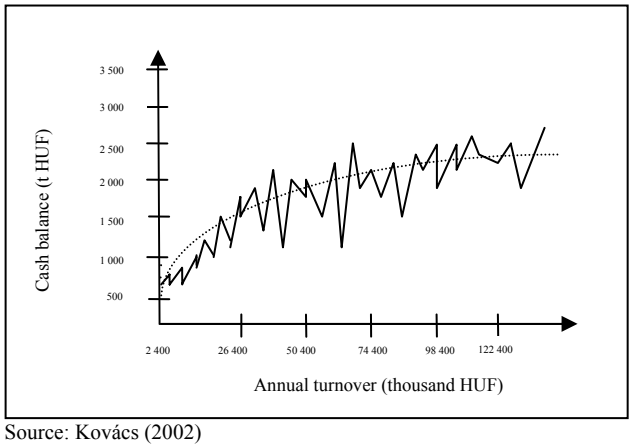
THE RELATIONSHIP BETWEEN CURRENT ACCOUNT BALANCE AND ACCOUNT TURNOVER

Based on the 60-year-old model of Miller and Orr, the optimal current account balance is one-third of the way between the lower and the upper limits, closer to the lower one. Surveys carried out at the end of the 1990s did not confirm the findings of Miller and Orr. In modern cash management companies pay attention to making their current account balance match their expected transactional needs as closely as possible, while maximizing interest. Ten years ago an analysis was conducted to find out how current account balances are distributed, and connected to that, what relationship can be demonstrated between the account balance and interests offered by banks [Kovács 1999]. The article outlines the effect of credit and deposit interests on current account balances. In addition, it also demonstrates that if the cash management of the company is free (i.e., not affected by lack of liquidity), the distribution of the current account balance is symmetrical, and the Gauss curve routinely used in statistics can be fitted on it. Furthermore, the article demonstrates that the optimal current account balance depends on the measure/system of credit and deposit interests offered to companies. On the other hand, it fails to give an answer to the question of what the optimal level of the current account balance is, or to the limits of fluctuation of the balance, as demonstrated by Miller and Orr.

Most companies usually place their disposable cash into short-term bank deposits, or less frequently into unit-linked funds. When they need the fixed deposits in order to secure liquidity, they release the funds; otherwise they will prolong them for a new term. This process can ensure efficient cash flow management. On the other hand, we did not consider the related costs incurred by the company. In case of term deposits, the banks do not charge fixed costs for premature withdrawal, and the loss of interest can also be minimized for deposits with different maturity. However, the management of the current account balance, the series of decisions made about the use of the cash inventory do incur costs, which can be placed in the category of administrative costs. Just consider that fund management fees fall due in the case of investment fund managers as well, but in the same way, in the case of bank deposits we can also expect a similar type of cost, which the banks include in their services (although they do not apply separate charges).

An analysis performed in 2001, based on the data of a commercial bank in Hungary, yielded interesting new results [Kovács 2002]. In this analysis, in addition to the balance, the number of transactions and the turnover volume of the corporate current account were also taken into consideration. Furthermore, the differences shown by customers with an overdraft compared to regular customers (those with no overdraft) were also checked. The results of the analysis shed new light on the assumptions held up to that point. Using the formula of the simple inventory management model applied in the research of Baumol, the value of the interest rate was considered as a choice between alternative options, i.e., the difference between keeping the funds on the current account and the interest yield of investment. In this case, based on the sample containing a high number of elements, it is possible to define the sum that the individual company incurs in a particular bank transaction as cost. In the research significant differences were demonstrated in terms of size, which could mostly be traced back to transaction volumes and characteristics of business operations. Thus small and medium-sized companies had to be distinguished, and the amount of administrative costs could be determined on this basis. The resultant amount can be determined based on the sample mentioned above, as about 2400 HUF for small companies and about 4500 HUF for medium-sized companies, and relying on these data it is easy to determine the optimal current account balance.

Figure 2 demonstrates that based on the resultant values, the average current account balance as a function of corporate account turnover can be described by a logarithmic curve. Parallel with the increase in the size of the company, the number of daily transactions also increases, as well as the daily average cash balance kept on the current account, which ensures liquidity. The logarithmic curve fitting the data increases by less and less with the rise of the number of transactions, i.e. even though the company conducts still more transactions, above a certain level the amount of liquid funds kept on the current account hardly changes. In fact, the total volume of transactions hardly increases beyond a certain daily frequency level, since daily credit and debit items of the same amount balance one another to an increasing extent. That way, it becomes less and less beneficial to increase the value of disposable cash balance, because of the benefits of liquidity and administrative costs.



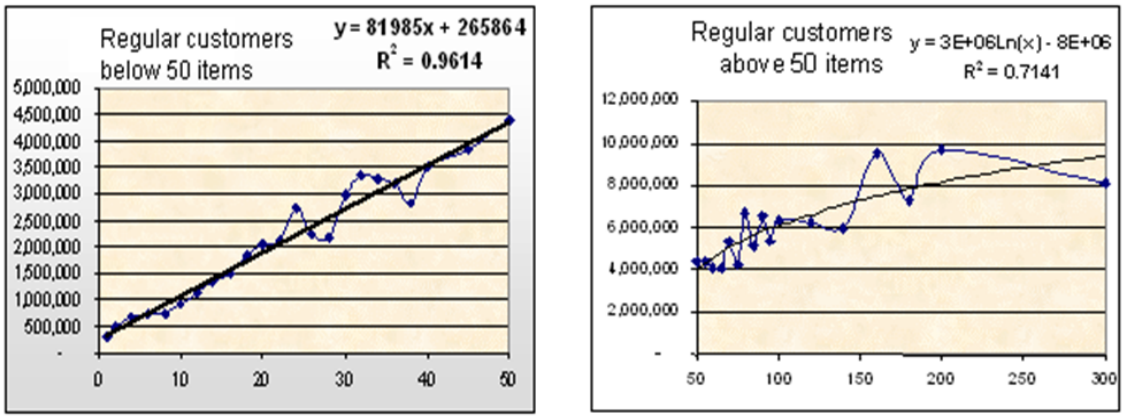
Source: Kovács (2002)

Figure 2: Assessment of the optimal cash balance

Data Explorer carried out the initial analyses, supplemented with additional data. Their aim was to demonstrate the formerly identified differences deriving from the size of the organization – i.e., financial management of smaller companies can be described by different features – at the level of the current account balance as well. At first they assessed the value of the average current account balance of companies performing an average monthly "x" (as a variable) number of transactions on the level of their entire customer portfolio. The results of the assessment confirmed the logarithmic curve presented earlier. The additional assessments produced a very high coefficient of determination (0.71). Carrying on the analysis, they assessed what kind of function can be used to approximate the data at a lower number of transactions (up to 100 transactions per month). In this case the best way to describe the values is a linear straight line, the coefficient of determination of which became even higher (0.96) than in the case of the logarithmic curve.

During the study another situation is also assessed, when rather than analysing the entire customer portfolio, the curves mentioned above are described based on the "account package holding" customers, who are more sensitive to interests and commissions. In this case the statements made concerning the total customer portfolio were also confirmed; i.e., in the case of cost-sensitive customers as well, the average current account balance can be fitted best by a linear, and then a logarithmic curve in respect of daily transactions. In this customer portfolio the curves were positioned somewhat lower.

In the case of regular customers, the results of the assessment are summarized by the graphs in Figure 3.



Source: Data Explorer analysis (2002)

Figure 3: Development of the average current account balance for regular customers

TOWARDS THE NEW MODEL

The high coefficient of determination of the curves resulting from the fitting of the regression lines gives reason to conclude that the curves fit the data quite well. Based on that, the following conclusions may be drawn. On one hand, it has been confirmed that the size of the company causes differences concerning the current balance as well. The smaller a company is, the lower balance it will keep on its current account, since this is sufficient to ensure an appropriate level of liquidity for the company. Above a certain number of transactions - which occurred at 100 transactions concerning the entire customer portfolio - the curve turns logarithmic, i.e. it becomes increasingly unnecessary to keep increasing the value of the balance. But why does this change occur?

In the case of small companies the number of daily transactions is minimal, and therefore it is simple to plan account balance movements. If the level of activity is two or three times higher, when the number of daily transactions is still low, the current account balance has to be higher proportionately, in a linear way. For larger companies we can already see significant account movements. Consequently, transactions of opposite direction (credit and debit transactions) cancel each other out on a daily level to an increasing extent, thus a certain equalizing effect occurs regarding the fluctuation of current account balances. The higher the number of daily transactions, the stronger is the equalizing effect we get, thus the fluctuation related to the volume of the disposable cash will relatively decrease, which is why we have the change from the linear curve, and this is precisely why the change is for a logarithmic curve.

Another important statement derives from this. The 60-year-old Baumol and Orr model presented at the beginning of this study tried to derive the size of the optimal current account balance primarily from the costs. The data of the 2000s – which was generated in the era of electronic banking – no longer support the old American model. In fact, from the symmetrical distribution of the current account balances inventory, the change from linear to logarithmic curve, and the daily transaction activity relationship that explains it, we can draw the conclusion that the current account balance is primarily

determined by transactional activity, i.e. daily cash flow changes, rather than administrative costs.

The analyses of current account balances are seen in a new light in that context, and the formerly created models should be reconsidered, discarded, and new models should be created. According to the new model, it is the opening deposit level of the relevant day, the transactional data of the relevant day and the statistically expected transactional volumes of the near future that determine the value of the closing deposit on the relevant day, i.e. the opening balance of the following day (D+1).

The statistical distribution of the value and frequency of credited and debited amounts is known, of which a few random credit and/or debit items are settled each day for smaller companies. However, bigger companies conduct so many transactions on a daily basis that at this level it becomes profitable to consider the offsetting (neutralizing) effect of credited and debited amounts. As a result of what we have said above, from the statistical frequency distribution of transactional amounts we obtain a new distribution for the current account balances. The resolution of the new model is the mathematical relationship of the statistical distribution of transactional amounts and average current account balances, which provides a significant deviation in case of a small number of transactions (i.e., no equalizing effect) and a high number of transactions (the equalizing effect is taken into account). Concerning average current account balances, a small number of transactions will result in a linear relation, while a high number of transactions results in a logarithmic relationship depending on traffic.

CONCLUSION

It should be noted for practicing economists that the cash management models created 60 years ago for the purpose of managing a small number of high-value transactions, with slow information flow and costly banking, operated on paper, are no longer valid. The new model, based on modern business practices, gives an answer to the question of what should be the planned size of corporate current account balances in the age of an accelerated and 100% electronic cash management driven economy.

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