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MILLER- ORR MODEL APPLICATION IN CASH CAPITAL MANAGEMENT IN VIETNAMESE ENTERPRISES

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The study introduces cash capital management models in enterprises including Baumol model, Miller-Orr model and Stone model, and introduces details of these models, pros and cons of each model. With the model characteristics and current situation of Vietnamese enterprises, the study has shown that the Miller-Orr model is more feasible in cash capital management at enterprises. It is noted that, based on the financial report data of Vietnam Dairy Products Joint Stock Company in 2017, the study illustrates application steps of Miller- Orr model in cash capital management in Vietnamese enterprises. The model application results show that the solvency and profitability of the enterprise are significantly improved compared to those before applying this model.

Key words: Miller - Orr model, budget management, cash capital management.

1. Introduction

Cash capital of enterprises consists of cash on hand, bank deposits and cash in transit. Cash capital is a direct factor that determines the solvency of an enterprise corresponding to a certain business scale. Cash flow reflects the movement of cash going in and out arising in a certain period of time from activities of an enterprise.

Cash capital management is one of the important contents of corporate financial management, an urgent requirement that determines the existence of an enterprise. Therefore, it is necessary to plan and control the in and out movement of cash arising during operation, ensuring the balance, matching between inflows and outflows for the operation of enterprises. For this, enterprises need to pay attention on cash capital management.

Goal of cash capital management is to fully and promptly meet the payment need of enterprises but

still ensure the highest profitability. The main contents of cash capital management in enterprises include: forecasting cash flow, determining the optimal fund balance, and monitoring and maintaining the optimal budget.

An alarming fact among many Vietnamese enterprises is that their income statement is profitable, but many businesses are still at risk of bankruptcy due to insolvency or inadequate cash to serve production and business. Therefore, cash capital management is vital for all enterprises. If an enterprise does not manage well or is not interested in managing budget, it will always fall into shortage or excessiveness of money and will not take advantage of investment opportunities.

Currently, the cash capital management has not been really focused in Vietnamese enterprises, even enterprises listed on the stock market. Although enterprises are aware of the fact that good cash cap-

ital management will maintain solvency as well as proactive source of money to increase profitability, the cash capital management in most Vietnamese enterprises is still unmethodical, highly flexible but not built based on scientific bases. In addition, the role of Chief Financial Officer (CFO) in the operational structure of many Vietnamese enterprises is unclear, accounting and financial works are overlapping. This situation leads to the urgent need to apply cash capital management in scientific and methodical manner in Vietnamese enterprises to maintain solvency as well as profitability of enterprises. Thus, the determination of optimal reserve on the basis of cash capital management models is one of the key solutions.

2. Overview and research purpose

Cash capital management is a popular topic in research around the world. The basic issues of cash flow management and its techniques are discussed in famous academic documents such as: Miller and Orr (1966), Stone (1972), etc. Besides, the basic concepts of cash flow management, concepts, models and techniques are introduced in classic books on corporate finance, known as: Brigham and Daves (1999), Fabozzi and Petersen (2003), Allman-Ward and Sagner (2003), etc. Many academic studies have demonstrated a close relationship between reasonable cash flow management and corporate financial performance (Ebben and Johnson, 2011; Farris and Hutchinson, 2003; Quinn, M., 2011). Based on research in the world, this article systematizes theoretical bases of three current cash capital management models including: Baumol model, Miller - Orr model and Stone model, then, make steps to apply the typical researched Miller - Orr model at Vietnam Dairy Products Joint Stock Company as a feasible solution to contribute to the cash capital management Vietnam Dairy Products Joint Stock Company in particular and Vietnamese enterprises in general.

3. Method and scope of research

Research method: The article uses a combination of statistics, comparison, analysis, synthesis methods and makes practical applications to clarify the theoretical bases.

Scope of research: The article studies and applies Miller - Orr model in cash capital management in Vietnamese enterprises with illustrative data of

financial statements of Vietnam Dairy Products Joint Stock Company in 2017.

4. Theoretical background

Currently, there are three models for determining the optimal reserve mentioned in the fund management theory including: Baumol model, Miller - Orr model and Stone model.

First: Baumol model (EOQ model)

In 1952, William Baumol was the first to propose a solution to resolve the conflict between payment demand and profitability. Baumol assumed that the business had a discrete cash flow with stable, unchanged net cash flow over the period. Therefore, naming the amount to be maintained during the period as C, the average cash balance of the enterprise will be C/2. The business budget change is steady and predictable.

When the budget is temporarily redundant, the company will buy securities; on the contrary, these securities will be sold if the fund is insufficient. Holding money instead of securities gives rise to two basic types of costs: opportunity cost and transaction cost. In particular, opportunity cost is measured by the securities return rate (k-%) multiplied by the average budget balance (C/2). Transaction costs for each securities sales is marked F.

If the enterprise needs to use the total amount of T, the number of times to sell securities will be T/C. Therefore, the total cost of holding (TC) is:

$$TC = k * \frac{C}{2} + F * \frac{T}{C}$$

The optimal budget level C * for the minimum total cost is:

$$C^* = \frac{2 * T * F}{k}$$

Thus, if the securities have a high profitability rate, enterprises should hold less money and vice versa. If the transaction costs for each securities sale are high, the general trend is to store money.

Contribution of the model: The Baumol model has facilitated enterprises to clearly see the fundamental trade-off between fixed costs of selling securities and opportunity costs for holding money.

Limitations of the model: In real business of enterprises, it is very rare that the inflow and out-

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flow are regular and firmly predictable, so the fund balance cannot be stable as C/2 in the model's assumption. Therefore, determining C* is not entirely accurate, only meaningful in theory.

Second: Miller - Orr model

The Miller- Orr model is developed by Merton Miller and Daniel Orr scientists and has overcome the above disadvantages of the Baumol model. Miller- Orr model is based on the assumption of random variable net cash flow with a normal distribution and difference from the average value of a quantity as budget revenue and expenditure variance (σ^2).

Therefore, cash balance of enterprise is unstable and can fluctuate in a range of values. In that range of fluctuation, Miller and Orr proposed an optimal level Z*, which is determined by the following formula:

$$d = 3 * (\frac{3}{4} * \frac{F * \sigma^2}{k})^{\frac{1}{3}}$$
$$Z^* = L + \frac{d}{3}$$
$$H = L + d$$

In which:

d: Budget range of fluctuation

k: Rate of return of securities or deposits (opportunity cost of holding money), if an enterprise does not hold liquid securities, then k is determined by the interest rate of 12 - month savings deposit

F: Securities cost of sales, if the company does not buy and sell securities, F is the lost interest rate of savings deposit as result by premature withdrawal

σ^2: Budget revenue and expenditure variance

Z*: Optimal fund balance

L: The lowest fund balance

H: Maximum fund balance

If an enterprise has a constantly fluctuating cash flow with great difference between revenue and expenditure, it needs to maintain a high level of cash balance. Conversely, if the cash flow is stable, the fund balance will be reduced. This is a model with high application value in practice, now widely used to determine the optimal budget for enterprises.

In order to ensure the balance between solvency and profitability, the optimal fund balance needs to be established. According to the Miller - Orr model, the budget balance is allowed to range from L to H, only when the budget balance is equal to or exceeds the above two limits, budget handling measures are applied. To adjust the budget balance to an optimal level, some of the following measures can be used: Changing payment policies, seeking opportunities of budget surplus investment, or seeking fund to offset the deficit.

Contribution of the model: The model allows money balances to fluctuate randomly instead of being totally dependent, which helps enterprises to determine closer to reality reserve. Besides, this model also allows the cash balance to increase and decrease, so the enterprise knows exactly when it is necessary to supplement it after reducing a certain amount.

Limitations of the model: The model builds on the assumption of variable cash flow under normal distribution with constant variance. However, the fact shows that cash flow does not always follow the normal distribution and correlates over time.

Third: Stone model

The Stone model is almost similar to the Miller-Orr model, but the Stone model point focuses on cash balance management. In particular, the model focuses on predicting future cash flows. When predicting the idle amount, the enterprise's cash is automatic and immediately returned to the designed state after the enterprise's cash has changed, generally not the minimum. The Stone model offers the same upper and lower limits as the Miller- Orr model, when the cash hits or exceeds this limit, the CFO will have to check and predict in the next few days whether the balance decreases or increases within the allowable limit. If in the short term, the amount of money is predicted to return to the limited range, the enterprise does not have to make any decisions regarding handling of fund. Conversely, if the amount of money does not return to the allowed range, the enterprise will have to make investment decisions or divestments. Notably, in the Stone model, the upper and lower limits are determined based on experience and personal views of the CFO.

Contribution of the model: The model is consistent with the decision-making process of managers. Because the model does not use academic formula or descriptive statistics and is not mandatory to use

control limits. Instead, managers can provide these limits based on practical experience.

Limitations of the model: The model does not mention the optimal reserve level, so it is difficult to compare with the above two models to select the appropriate model for the enterprise. Notably, in case the CFO's capacity is not enough to forecast cash flow, the use of Stone model is very risky.

5. Research contents and results

Miller - Orr model is more feasible in terms of applicability to the actual cash capital management in Vietnamese enterprises because: (1) Baumol model cannot be applied to Vietnamese enterprises as their cash flow often fluctuates and can not be predicted in advance; (2) Roles of CFO in Vietnamese enterprises are inadequate, and the application of Stone model is very risky.

The application of Miller - Orr model is meaningful for Vietnamese enterprises: enterprises will have an effective way of managing cash, fully and promptly meeting the payment needs of enterprises, but still ensuring the highest profitability. Besides, Miller- Orr model also helps Vietnamese enterprises minimize the total costs related to cash in the budget, which are opportunity costs and transaction costs.

Thus, Miller- Orr model can be applied to the actual cash capital management in Vietnamese enterprises. To explain in detail how to apply Miller - Orr model in cash capital management in enterprises, the article uses the 2017 financial statement data of Vietnam Dairy Products Joint Stock Company to illustrate the application of the model, thereby proposing appropriate adjustment measures.

Vietnam Dairy Products Joint Stock Company was established in 1976 and changed to operate under Joint Stock Company model since 2003. In January 2006, its shares were officially traded on Ho Chi Minh City Stock Exchange with stock code as VNM. According to the selection result of the 100 most powerful brands in Vietnam, VNM is the No. 1 food brand in Vietnam with the leading market share. Domestic revenue increased by an average of 20-25% annually. VNM maintained its leading role in the domestic market and competed effectively with foreign milk brands. Its market share is more than 50% in Vietnam dairy industry with the second largest market capitalization in Vietnam stock market.

Currently, the cash capital management in VNM is mainly based on experience and focused on solving arising problems. Therefore, VNM can apply Miller - Orr model with the following specific steps:

Step 1: Determining the minimum budget balance

Based on the ending cash and cash equivalents balance from the first quarter of 2015 to the fourth quarter of 2017, combined with the data provided by the Finance Department, the secured minimum budget balance was VND 895.67 billion.

Step 2: Determining the budget range of fluctuation d

Since VNM has term deposits at commercial banks and does not hold liquidity securities, k is determined by the interest rate of 12 - month savings deposit. Based on the published data of the State Bank and author's calculations, the average savings interest rate in 2014-2017 period was 6.43% / year.

F is calculated by the lost interest rate of the savings deposit as result by premature withdrawal. In particular, the call deposit interest rate is average call deposit interest rate in 3 years from 2014 to 2017 which is 0.59% / year. Thus, if the enterprise with draws money before maturity, the opportunity cost is 5.83% / year.

σ^2 is calculated based on the daily net cash flow data of 2017 provided by the Financial Department which was VND 18056 billion.

Therefore, the budget fluctuation range d = VND 69.23 billion.

Step 3: Determining the optimal and maximum fund balance

$Z^* = 918.75$ billion dong

H = 964.90 billion dong

Step 4: Handling budget surplus (deficit)

After determining the optimal fund balance of the enterprise through the Miller - Orr model, the enterprise needs to develop a plan to regulate the cash flow to maintain solvency and at the same time increase the profitability of capital in the enterprise.

The data in Table 1 shows that quarter ending budget balance of VNM in 2017 was not optimal, even most outside the upper limit and lower limit of the budget fluctuation range, necessary to be adjusted to the optimal cash balance Z^*.

Table 1: *Cash flow statement of Vietnam Dairy Products Joint Stock Company in 2017*

Unit: billion VND

Indicators	Code	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Net cash flow from business activities	20	3035	6038	8555	9602
Net cash flow from investment activities	30	(181)	(1759)	(1325)	(1771)
Net cash flow from financial activities	40	(1 292)	(4354)	(7228)	(7536)
Net cash flow in term (50 = 20 + 30 + 40)	50	1562	(75)	2	295
Beginning cash and cash equivalents	60	655	655	655	655
Effect of exchange rate change	61		11	11	13
Ending cash and cash equivalents (70 = 50 + 60 + 61)	70	2217	591	668	963

Source: Financial Statement of Vietnam Dairy Products Joint Stock Company in 2017

Specifically, the budget balance by the end of the first quarter was 2217 billion VND, 964.90 billion higher than the maximum level H of the budget fluctuation range, so it was necessary to adjust the budget balance to the optimal level, with surplus of VND 1298.25 billion. The most reasonable choice for VNM in this case was to repay the principal of short-term loans of the previous period. Under this plan, spending cash flow increased and interest payment reduced. The average interest rate for short-term loans of VNM in 2017 was 7%/year, contributing to increasing revenue from premature withdrawal of savings of VND 1321.37 billion, at the same time reducing the interest payment due to the increase in principal payment of VND 23.12 billion.

After adjusting, the budget balance by the end of the first quarter of 2017 would be brought to the optimal level, then the budget balance by the end of the second quarter would increase to VND 854.75 billion, lower than the minimum level L, so the budget balance should be increased to the optimal level of VND 918.75 billion, the difference was VND 64 billion. In fact, VNM did not hold liquid securities, and at the same time, the enterprise has available savings deposits at banks. Therefore, the most appropriate option to offset budget deficit in this case was to withdraw savings to increase cash flow for the enterprise in the second quarter of 2017. Upon premature withdrawal of savings, the enterprise would only receive interest rate based on demand interest rate (0.59%/year) instead of an average level (6.43%/year), so the interest flow in the second quarter is reduced accordingly. Therefore, in order for the budget balance to increase by VND 64 billion by the end of the second quarter, the enterprise would increase revenue from premature withdrawal of savings of VND 64.95 billion and reduce collection of interest from premature withdrawal of savings of VND 0.95 billion.

Because the budget balance by the end of the second quarter after adjustment returned to the optimal level, the budget balance by the end of the third quarter increased to 931.75 billion dong, within the allowable fluctuation range, so there was no need to adjust.

Although the balance by the end of the third quarter was in range of fluctuations, the budget balance by the end of the fourth quarter increased to VND 1239.75 billion, exceeding the upper limit of the fluctuation range, so it needs further adjustment. The surplus amount was 321 billion VND. The same adjustment was made as in the first quarter to bring

the budget balance by the end of the fourth quarter to the optimal level.

The adjustment results are given in table 2 below:

cial cost decreased by 28.84 billion dong, other items remained unchanged. Therefore, pre-tax profit increased by VND 27.89 billion, corporate income tax (with the 2017 corporate income tax rate of

Table 2*: Cash flow statement of Vietnam Dairy Products Joint Stock Company in 2017 after adjustment in Miller-Orr model*

Unit: billion VND

Indicators	Code	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Reducing loan interest due to increase of principal repayment		23.12			5.72
Increasing revenue from premature savings withdrawal			64.95		
Net cash flow from business activities	**20**	**3058.12**	**6102.95**	**8.555**	**9607.72**
Reducing interest due to premature savings withdrawal			(0.95)		
Net cash flow from investment activities	**30**	**(181)**	**(1759.95)**	**(1325)**	**(1771)**
Increasing debt repayment		(1321.37)			(326.72)
Net cash flow from financial activities	**40**	**(2613.37)**	**(4354)**	**(7228)**	**(7862.72)**
Net cash flow during period (50 = 20 + 30 + 40)	**50**	**263.75**	**(11)**	**2**	**(26)**
Beginning cash and cash equivalents	**60**	**655**	**918.75**	**918.75**	**931.75**
Effect of exchange rate change	**61**		**11**	**11**	**13**
Ending cash and cash equivalents (70 = 50 + 60 + 61)	**70**	**918.75**	**918.75**	**931.75**	**918.75**

Source: Financial report of Vietnam Dairy Products Joint Stock Company in 2017 and the author's calculations

Thus, comparing the balances at the quarter ends in Table 1 and Table 2, we can see that Miller- Orr model application will maintain the budget balance at the optimal level or within a reasonable range.

6. Evaluation of research results

To verify results after applying Miller - Orr model in VNM in 2017, the researchers conducted a comparison of some basic financial indicators before and after budget adjustment.

Regarding the income statement in 2017, due to premature withdrawal of savings in the second quarter, financial revenue decreased by VND 0.95 billion. At the same time, the principal debts were cleared in the first and fourth quarters, so the finan-

20%) VND 5.58 billion and profit after tax VND 22.31 billion.

Regarding the balance sheet on December 31, 2017, from the asset aspect: cash decreased by VND 1532.94 billion, savings deposits decreased by VND 64.95 billion, making total assets decrease by VND 1597.89 billion. From the liability aspect: short-term loans decreased by VND 1648.09 billion, payable corporate income tax increased by VND 27.89 billion, undistributed profits increased by VND 22.31 billion, causing a total capital reduction of VND 1597.89 billion.

Thus, after applying Miller - Orr model in cash capital management, VNM's business results

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increased by VND 22.31 billion of profit after tax. Although the asset size decreased by VND 1597.89 billion, short-term debts also decreased correspondingly to VND 1648.09 billion. This result would reduce liquidity risk for the enterprise.

Continuing to calculate the financial ratios of VNM before and after applying the Miller - Orr model, we will see more clearly the effect of this model. Results are given in table 3 below:

tion of this model in enterprises is completely feasible. Applying the Miller - Orr model in cash capital management together with synchronous solutions to improve financial management efficiency will contribute to the goal of maximizing enterprise value.

Table 3: *Financial ratios of Vietnam Dairy Products Joint Stock Company in 2017 before and after applying the Miller- Orr model*

Indicators	*Before application of Miller - Orr mode*	*After application of Miller - Orr mode*	*Balance*
Current solvency (times)	1.992	2.189	+0.197
Quick solvency (times)	1.597	1.718	+0.121
Instant solvency (times)	0.094	0.196	+0.102
Return on assets - ROA (%)	29.648	31.148	+1.500
Return on equity rate- ROE (%)	43.053	43.146	+0.093

Source: Author's synthesis and calculation

The results in Table 3 show that the application of Miller - Orr model in cash capital management at Vietnam Dairy Products Joint Stock Company has brought positive effects: Improving solvency, increasing profitability, thereby contributing to improving the efficiency of cash capital management in enterprises. Since then, VNM's business performance has also increased accordingly.

7. Conclusion

The application of Miller- Orr model will provide Vietnamese enterprises with appropriate cash capital management solutions, strengthen solvency, and improve profitability. Enterprises should use this model in calculating the annual optimal fund balance, or when the model components such as σ2, k, F change, enterprises need to adjust monthly, quarterly balance. Although the fluctuation of cash flow in enterprises is very complex, but with the help of financial accounting software, the applica-

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Summary

Nghiên cứu giới thiệu các mô hình quản trị vốn bằng tiền tại doanh nghiệp là mô hình Baumol, mô hình Miller - Orr và mô hình Stone. Trong đó, nghiên cứu giới thiệu chi tiết về các mô hình này cũng như những ưu nhược điểm của mỗi mô hình. Với đặc điểm của các mô hình và thực trạng các doanh nghiệp Việt Nam hiện nay, nghiên cứu đã chỉ ra mô hình Miller- Orr có tính khả thi cao hơn trong quản trị vốn bằng tiền tại doanh nghiệp. Đáng chú ý, dựa trên số liệu báo cáo tài chính của Công ty cổ phần sữa Việt Nam năm 2017, nghiên cứu tiến hành minh họa các bước ứng dụng mô hình Miller - Orr trong quản trị vốn bằng tiền tại doanh nghiệp Việt Nam. Kết quả ứng dụng mô hình cho thấy, khả năng thanh toán và khả năng sinh lời của doanh nghiệp được cải thiện rõ rệt so với trước khi áp dụng mô hình.

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