# Modelling a cash asset management system in e-commerce

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The modern economy is rapidly moving to electronic money circulation, adapting to the pace of globalization. Therefore,e-commerce and financial services for trade transactions are gaining momentum and require additional attention and assessment of financial liquidity.

In a regime where transactions are conducted around the clock and settlements with customers are made daily, the risks of losing liquidity of a financial enterprise increase (from receiving a large number of requests for refunds from customers that exceed the amount of sales obligations to the customer to the liquidation of the partner bank)[4].

Therefore, tools for forecasting the results of a financial company's activities for a year or more are almost losing their relevance for operational activities, which require a flexible and fastest possible tool primarily to assess the sufficiency of cash in the company's accounts for the operational management of its life [1].

Among the most common models for assessing the adequacy of funds are the Bernard Baumol model, the Miller-Orr model and Monte Carlo simulation modelling, but each of these models has a number of disadvantages in relation to this problem, namely

the models assume that the required (minimum) amount of funds is known at the time of the modelling, which already implies an expert judgement in a volatile and risky market, and therefore significantly reduces the level of confidence in the results;

cash flows in these models are chaotic, i.e. they involve a large number of probabilities of an event occurring.

Therefore, in order to build a system that would allow forecasting the right amount of cash, it is necessary to find a model that would allow forecasting the behaviour of a client's sales volume directly, with subsequent scaling to the entire enterprise (project).

For this approach, it is worth paying attention to the Harrod-Domar economic growth model.

Let's consider a variant of the Harrod-Domar model with a consumption indicator $C(t)$ that grows at a constant rate $r$: $C(t) = C(0)e^{rt}$.

The differential equation of this model is as follows:

$$Y(t) = B\frac{dY}{dt} + C_0 e^{rt}. \tag{1}$$

Of course, to apply this model, you need to prepare the input data. For example:

$C(t)$ – commission expenses (interest rate of the partner banks for the transaction),

$I(t)$ – gross profit (let's assume that it is not distributed but invested, i.e. the funds remain in circulation),

$Y(t) = C(t)+I(t)$ – operating income (commission income of a financial institution for conducting a transaction).

The input data should be adjusted to base period prices by applying inflation indices (or exchange rates) and cleaned from the impact of temporary promotions (e.g., promotional commission reductions by partner banks) to offset the impact of external factors on the model's behavior.

Next, find the trend dependence of consumption over time and calculate the rate of change in consumption (multiplier):

$$r = \sqrt[23]{\left(\frac{C_3}{C_2}\right)\left(\frac{C_4}{C_3}\right)\cdot ... \cdot\left(\frac{C_n}{C_n}\right)} - 1. \tag{2}$$

Finally, if

$$I(t) = B\frac{dY}{dt}, \quad \text{then} \quad B_t = \frac{I_t}{Y_{t-1}-Y_t}. \tag{3}$$

It is important to bring the obtained values of the forecasted gross income back to actual prices by applying inflation indices in the opposite direction.

The application of the proposed model in practice provides fairly reliable information about customer behavior, with minimal deviation from actual data (within 5 % if sales volumes increase).

Having received the probable data on the client's future income, we have a clear indicator of future sales volumes (commission income / commission rate * 100), future commission expenses (sales volumes * commission rate of partner banks), and therefore we have all the data to build a forecast cash flow of operating activities with high accuracy of calculations and without the use of expert assessment, both for an individual client and for the company as a whole.

By combining this data with the payment calendar, namely adding other income and expenses planned for the period, we get a forecast Cash-Flow, forecast P&L and a lot of other useful analytical information for a given period of time.

Of course, this method requires additional research, it does not take into account such factors as refunds to payers for refusal of goods or services, a decline or sharp increase in customer sales, etc. (which is planned to be carried out in further research when solving relevant problems), but among the advantages of its use we should note

- ease of application (using programming methods for Big Data or even Excel for small enterprises)

- accuracy of the results obtained;

- a wide range of applications of the obtained indicators (cash reserves management, forecasting financial results, assessment of cooperation with specific customers or service providers, etc;)

- the ability to easily maneuver changes in income and/or expense rates [3].

As the global economy undergoes further digital transformation, a well-designed cash management system that is tailored to the specific challenges of e-commerce becomes even more important. Because of this, the ability of a cash management model to seamlessly integrate with and take advantage of digital tools enables businesses to achieve sustainable success in the evolving digital environment.

The integration of digital technologies, such as blockchain for secure transactions and artificial intelligence for predictive analytics, increases the efficiency and effectiveness of cash management. In addition, as digital payment methods become more common, the model must adapt to accommodate and optimize these digital transaction channels.

Therefore, modelling the systematic management of cash assets in e-commerce is extremely relevant given the dynamic nature of the sector, characterized by unprecedented growth, technological advancements and changing consumer behavior.

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