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COMMERCIAL BANK CREDIT RISK FORECASTING

aBSTRACT. This article contains the results of forecasting the risk of the customer loan portfolio of a commercial bank on the basis of the binary choice model. The outstanding debt of the loan portfolio granted to individual clients is considered as an indication of credit risk, the probability of increasing the share of outstanding loans payable is regarded as a measure of credit risk. Forecasting of stock indexes affecting the probability of increasing the share of outstanding loans payable was carried out on the basis of singular spectrum analysis and adaptive models with a damped trend. Evaluation of the accuracy of models forecasting stock indexes was conducted by means of retrospective forecasts and with the use of the mean absolute percentage error of the forecast. The study shows that throughout 2012 there was an expectation of a decrease in the fluctuations of probability, of an increase in the share of outstanding loans payable, whereas by the middle of the third quarter and the year-end an increase in risk for the client loan portfolio was expected.

KEY WORDS. Loan payable, forecasting credit risk.

One of the most important tasks in developing risk management systems is forecasting their future values. The probability of increasing the share of outstanding accounts receivable can be considered as a measure of credit risk. The assessment of probability of an increase in the share of outstanding loans p_t^* is:

$$p_t^* = F(x_t^T b) = F(z_t^*), \qquad (1)$$

where

$$z_t^* = 16,41 - 9,76\, x_{1t} - 4,11\, x_{2t-3} + 13,94\, x_{3t-6} - 13,04\, x_{4t-6} - 7,01\, x_{5t-6} + 3,75\, x_{6t}; \quad (2)$$

x_{1t} — FTSE 100 stock index growth rate at time t;

x_{2t-3} — Hang Seng stock index growth rate at time t-3;

x_{3t-6} — NASDAQ 100 stock index growth rate at time t-6;

x_{4t-6} — DAX stock index growth rate at time t-6;

x_{5t-6} — Nikkei 225 stock index growth rate at time t-6;

x_{6t} — Sectoral RTS index — oil and gas growth rate at time t.

Research [1] shows that the probability of an increase in the share of outstanding loans is influenced by the following stock indexes: FTSE 100, NASDAQ 100, Hang Seng, DAX, Nikkei 225 and the sectoral RTS index for oil and gas. A graph of Hang Seng stock index dynamics is shown in Fig. 1.

The information on the percentage of outstanding accounts payable and values of stock indexes for the period 2004-2009 was used as the information base while conducting the forecast. A retrospective forecast was made for the period from 2010 to 2011.
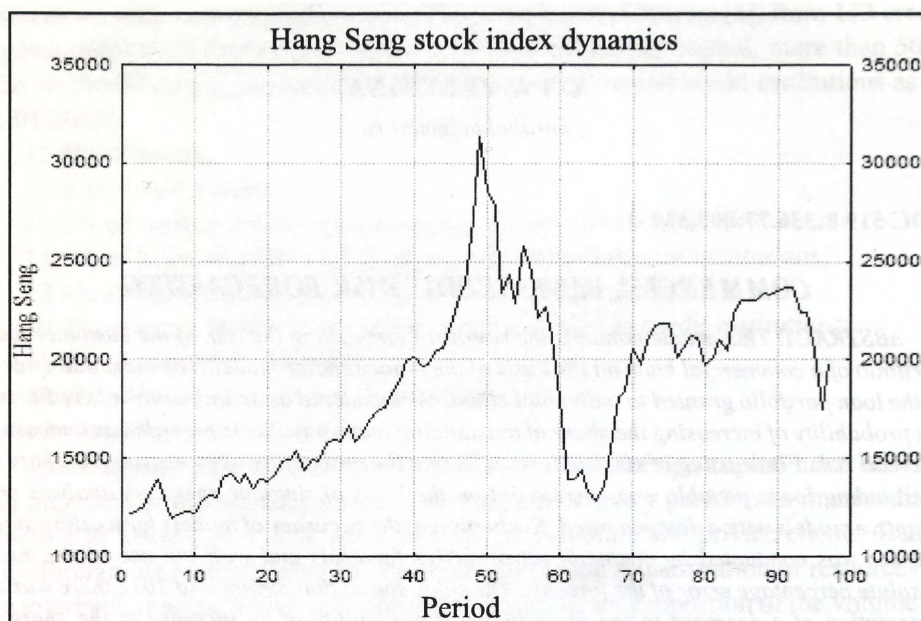
Fig. 1. Graph of the stock index Hang Seng's dynamics for the period 2004-2011

The forecasting of stock market indexes can be conducted by means of the «Caterpillar»-SSA method [2]. The advantages of this method include the fact that there is no requirement for stationary series in the conditions of applicability. Besides, knowledge of the trend model and information about the presence of periodic components and their periods are not needed.

Information about the time window length and the values of the mean absolute percentage error of the forecast obtained by constructing a retrospective forecast for 2010-2011 is presented in Table 1.

Table 1

**Time window length and values of mean absolute
percentage error of the forecast**

Index name	Time window length	Values of mean absolute percentage error of the forecast
FTSE 100 stock index	96	1,8%
Hang Seng stock index	84	22,8%
NASDAQ 100 stock index	84	11,1%
DAX stock index	60	7,4%
Nikkei 225 stock index	84	11,8%
Sectoral RTS index — oil and gas	84	7,5%

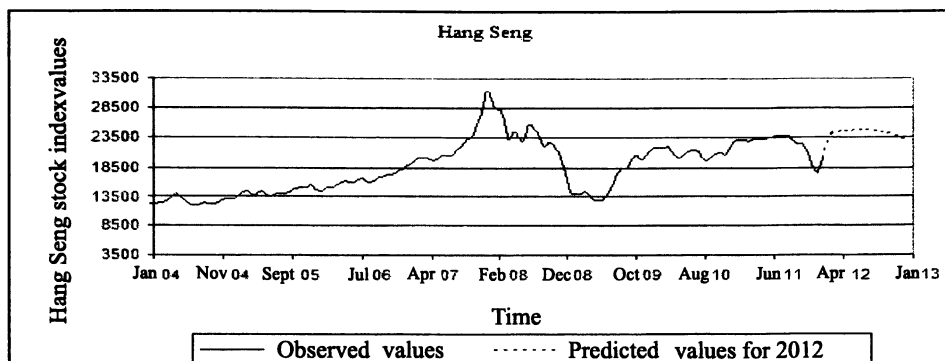Graphs of observed and predicted values of the Hang Seng stock index are shown in Fig. 2.

Fig. 2. Graphs of observed and predicted values of Hang Seng stock index

Analyzing the dynamics of stock index charts, one can see that each has a damped trend. Therefore, a short-term forecast of the above mentioned indexes can also be made through adaptive models with a damped trend. Gardner and McKenzie suggested the following [3]:

$$L_t = \alpha \cdot Y_t + (1-\alpha) \cdot (L_{t-1} + \varphi \cdot B_{t-1}); \qquad (3)$$
$$B_t = \beta \cdot (L_t - L_{t-1}) + (1-\beta) \cdot \varphi \cdot B_{t-1}; \qquad (4)$$
$$Y_{t+h} = L_t + (\varphi + \varphi^2 + \ldots + \varphi^h) \cdot B_t, \qquad (5)$$

where L_t —time series level at time t;

B_t — trend slope coefficient of time series at time t;

h —forecasting horizon.

The parameters for smoothing the level and the trend are α and β, while φ is the parameter of damping or autoregression.

The evaluation of models for predicting the indexes and the value of the mean absolute percentage error obtained by constructing a retrospective forecast for 2010-2011 is shown in Table 2.

Table 2

**Evaluation of models for predicting stock indexes and values
of mean absolute percentage error of forecasts**

Index name	Model evaluation	Values of mean absolute percentage error of the forecast
FTSE 100 stock index	$Y_{t+h} = L_t + (0{,}031 + 0{,}031^2 + \ldots + 0{,}031^h) \cdot B_t$ $L_t = L_{t-1} + 0{,}031 \cdot B_{t-1} + 0{,}747 \cdot \varepsilon_t$ $B_t = 0{,}031 \cdot B_{t-1}$	2,2%

Hang Seng stock index	$Y_{t+h}=L_t+(0{,}536+0{,}536^2+\ldots$ $+0{,}536^h)\cdot B_t$ $L_t=L_{t-1}+0{,}536\cdot B_{t-1}+0{,}575\ \varepsilon_t$ $B_t=0{,}536\cdot B_{t-1}$	5,9%
NASDAQ 100 stock index	$Y_{t+h}=L_t+(0{,}331+0{,}331^2+\ldots$ $+0{,}331^h)\cdot B_t$ $L_t=L_{t-1}+0{,}331\cdot B_{t-1}+0{,}693\ \varepsilon_t$ $B_t=0{,}331\cdot B_{t-1}$	5,6%
DAX stock index	$Y_{t+h}=L_t+(0{,}733+0{,}733^2+\ldots$ $+0{,}733^h)\cdot B_t$ $L_t=L_{t-1}+0{,}733\cdot B_{t-1}+0{,}451\ \varepsilon_t$ $B_t=0{,}733\cdot B_{t-1}$	16%
Nikkei 225 stock index	$Y_{t+h}=L_t+(0{,}551+0{,}551^2+\ldots$ $+0{,}551^h)\cdot B_t$ $L_t=L_{t-1}+0{,}551\cdot B_{t-1}+0{,}538\ \varepsilon_t$ $B_t=0{,}551\cdot B_{t-1}$	10,6%
Sectoral RTS index — oil and gas	$Y_{t+h}=L_t+(0{,}449+0{,}449^2+\ldots$ $+0{,}449^h)\cdot B_t$ $L_t=L_{t-1}+0{,}449\cdot B_{t-1}+0{,}594\ \varepsilon_t$ $B_t=0{,}449\cdot B_{t-1}$	15,7%

Graphs of observed and predicted values and the regression residual of the Hang Seng stock index are shown in Fig. 3.
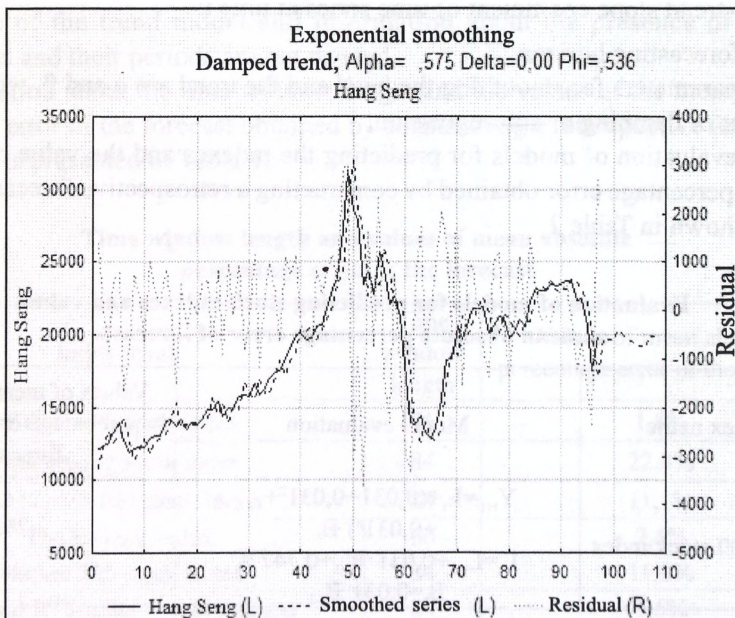

Fig. 3. Graphs of observed and predicted values and the regression residual of the Hang Seng stock index

Thus, when constructing the forecast of the probability of growth in the share of outstanding payables, one can use the results of forecasting the following indexes:

— FTSE 100, DAX and the sectoral RTS stock indexes — Oil & Gas obtained by means of «Caterpillar»-SSA;

— Hang Seng, NASDAQ 100, Nikkei 225 stock indexes obtained by means of methods with damped trend and additive seasonal components.

Projected values of the probability of growth in the share of outstanding accounts receivable obtained by means of the probit model (1) - (2) are shown in Fig. 4.

According to Fig. 4 in April, May, July and October 2012, the probability of growth in the proportion of outstanding accounts payable will exceed 0.5. The increased probability of growth in the share of outstanding accounts payable in April 2012 is connected with another round of crisis in the Eurozone. In accordance with the constructed forecast throughout 2012, it is expected that the fluctuations of the probability of growth in the share of outstanding debt will decrease. However, by the middle of the third quarter and year-end the probability of growth in the share of overdue loans to individuals is expected to increase.
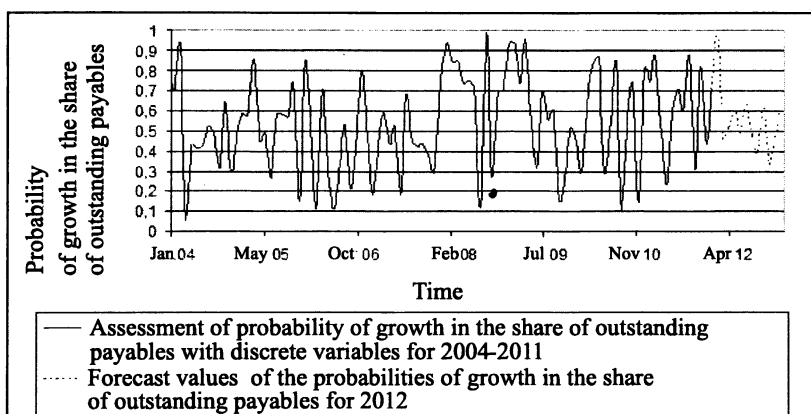
Fig. 4. Graph of forecast values of the probabilities of growth
in the share of outstanding payables

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