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ESTIMATION OF RISK OF THE BANK ACTIVITY ON THE CURRENCY MARKET

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The article is devoted to the elaboration of the scientific and practical reccomendations for the formation of the cost and structure of the bank currency portfolio according to the level of risk of currency fluctuations. It has been noted that the consideration of the dynamics of the costituent currencies risk estimates must be taken into account in the formation of currency portfolio. The main approaches to the definition of the «currency risk» have been isolated. The comparative characteristic of methods of the currency risk estimation has been formed. These methods are: stastistical, expert, analytical, analogies and combined. It has been determined that the results of the calculation of the «value at risk» (VaR) are: absolute estimate of VaR, relative estimate of VaR, estimate of capital at risk CaR. The methods of the estimation of VaR have been classified. These methods are: analitical (delta-normal, covariance-variation, parametric methods); historical modeling method (non-parametric methods); semiparametric methods (theory of extreme values and methods of maximum likelihood); Monte Carlo simulation method. The comparative characteristic of these methods has been formed by such criterias as: adequacy to nonlinear tools, taking into account volatility, measurement of extreme situations, model risk, sample size, computational complexity, clearness, simplisity of using. The dynamics and volatility of USD and EUR exchange rates for 2010−2016 on the Ukrainian curency market have been investigated. The dynamics and structure of the currency portfolio of PJSC «PRIVATBANK» for 2012−2016 have been analized. By means of correlation analysis the relation between open currency position of bank and the components of the estimate of the curency rate changes for each curency and a portfolio as a whole has been determined. The relative estimate of VaR for the currency portfolio of PJSC «PRIVATBANK» for 2012-2016 has been obtained by delta-normal parametric method with probability 99%. The correlation between VaR and currency portfolio structure and cost has been obtained.

Key words: currency risk, currency rate, currency rate volatility, value at risk, delta-normal parametric method, currency portfolio.

Introduction and problem definition

Current stage of the international relationships of Ukraine cash flows of which are serviced by domestic banks bring out the increasing of volumes of financial transactions in different currencies. These transactions are carried out in conditions of instability in the national economy and unpredictable volatility of floating exchange rates. The growth of volumes and kinds of the currency operations exacerbates the problems of currency risk regulation at the level of individual bank. This regulation is especially actual in the conditions of the deficit of foreign currency in the Ukrainian economy, reduction of state gold and foreign exchange reserves, significant reduction of foreign investment.

The estimation of risks is an important component of the management system of currency risks of the bank within which a regulative influence on the components of currency risk is formed and ways to reduce risks and strategy of the bank on the currency market are determined.

Analysis and research publications

The methods of analysis of the bank risks were investigated in world banking practice by K. Alexander, P. Artsner, K. Dowd, F. Jorion, K. Acerby, J. Kotter, K. Loss, F. Site etc. In the domestic economic literature the essence and classification of currency risks of the financial and credit institutions were investigated in works of scientists-economists O.I. Baranovskyi, T.A. Vazhevska, V.M. Hal, A.A. Gryschenko, L.O. Prymostka, P.M. Senysch, O.M. Sokhatska, S.O. Yaremenko. The elements of the estimation of the state of the banking system are covered in works of famous scientists and practitioners V.M. Heiets, V.I. Mischenko, A.I. Moroz, M.I. Savluk, V.A. Yuschenko etc.

Foreign scientist H. Suvorian proves the existence of direct connection between the value of currency risk of individual bank and three variables: mistakes in forecasts due to the insufficient account of the effect of medium and long-term currency fluctuations on the bank's cash flows; the size of alternative costs for the chosen currency risk management strategy; the size of the currency position of the bank as the difference between the requirements and obligations of the bank in foreign currency [5, P. 34].

There are four components in the NBU practice of the risk estimation:

− quantity of risk (level and volume of risk) is characterized as insignificant, moderate, significant;

− quality of risk management − shows the level of detection, measurement, control and monitoring of risk − is characterized as high, such that needs to be improved, low;

− cumulative risk − a generalized conclusion that reflects the level of concern of supervisors, taking into account both the quantity of risk and the quality of risk management and the relative importance of each of these aspects; mitigating factors (eg, insurance) can affect the estimation of this risk; this estimation determines the strategy of supervision;

− direction of risk − the probable change of the cumulative risk during the next 12 months; decreased direction of risk indicates that during the next 12 months on the basis of available information a reduction in cumulative risk is expected; stable direction points to an absence of changes in the level of cumulative risk; increased direction indicates that the cumulative risk will increase in 12 months [7, P. 23].

Foreign researcher Chan Vu Kionh assigns the main role of the currency position in the estimation of the currency risk of the bank [14, pp. 155-157]. Domestic researcher of the currency risks of the commercial banks K. Sveshnikova points that elasticity of the transaction and translation risks always equals one [11, P. 150].

Selection of the main components of currency risk, approaches and principles of the estimation of its components allows determining the level of risk of the bank in operations with foreign currencies and precious metals more accurately.

Despite on the existence of a large number of methods of the currency risks estimation, the problems of the formation of the scientific and practical providing for the determination the cost and structure of a currency portfolio of the bank taking into account the dynamics of estimates of the risks of the currencies included in its composition remain unresolved.

Purpose of the article

The purpose of the article is the elaboration of the scientific and practical reccomendations for the formation of the cost and structure of the bank currency portfolio according to the level of risk of currency fluctuations. The tasks for achivment of this purpose are: to analyse the methods of the quantitative estimation of the currency risks; to estimate the influence of the components of exchange rate changes on the cost of a currency portfolio and level of the bank's currency risk for each currency; to determine the main currency which part in the portfolio structure has the most impact on currency risk.

The general research and statistical methods have been used for the resolving of these tasks: comparison − for the analysis of the methods of the quantitative estimation of currency risks; correlation analysis − for the estimation of the connection between the open currency position and components of the estimation of the exchange rate changes for each currency and determination the main currency which part in the portfolio structure has the most impact on the currency risk; delta-normal parametric method − for the estimation of possible losses of the cost of a currency portfolio (VaR) from the fluctuation of exchange rates.

The scientific novelty of the article is in the further development of the scientific and practical approach to the formation of the cost and structure of the bank's currency portfolio, were, unlike existing ones, the components of the estimation of possible losses of the cost of a currency portfolio from the fluctuation of exchange rates have been taken into account in more details. It allows with a higher level of validity to determine the size of the bank's open currency position for each currency and the main currency which part in the portfolio structure has the strongest connection with currency risk.

Presenting the main material

The analysis of the existing opinions about definition «currency risk» allowed reaching conclusion that the most scientists determined it as the probability of cash losses associated with fluctuations in exchange rates. But it is expedient to outline the following approaches by the authors from the position of estimation of currency risk and formation of managerial influence on its level: from subjects of currency market (L.I. Donets, O.V. Dziubliuk, V.I. Mischenko, V.V. Vitlinskii, V.A. Yuschenko); from the economic and account points of view (N.V. Bozhydarnik, T.V. Bozhydarnik, Regulation (standard) of accounting 13 «Financial instruments», L.O. Prymostka, P.S. Rouz, T.V. Struchenkova, V.M. Sheludko); by risk management (Ye.A. Bobrov, A.A. Lobanov, A.V. Chuhunova); by the distinction of the main directions of currency risk (M.A. Rebryk); by a list of currency transactions, which is inherent in the risk (I.V. Larionova, A.P. Shihverdiiev); by consideration of the prices for bank metals (Basel

Committee on Banking Supervision, National Bank of Ukraine).

It is advisable to hold on the opinion of the professor L.O. Prymostka when solving the problem of obtaining the most accurate quantitative risk estimate, depending on the fluctuation of exchange rates. According to this opinion the currency risk − is the probability of the financial losses due to the fact that the exchange rate of one currency for the other changes over a certain period of time [12, P. 51].

The authors [2, pp.131-133; 3, pp. 253-255; 4, pp. 58; 7, pp. 16-17; 10, pp. 83-84; 13; 15, pp. 385-386] recommend to estimate the currency risks by stastistical, expert, analytical, analogies and combined methods with taking into account their advantages and disadvantagies (table 1).

The amount of unexpected losses which can be covered at the expense of economical capital attracts the most interest for the banking risk-management. According to Basel II standards the economical capital is a residual between the maximum amount of possible losses and expected losses [6, pp. 115]. Under this approach the worth of «value at risk» (VaR) is used for the calculation of the economical capital. VaR − is an expressed in monetary units of the base currency estimate of losses which cannot be exceeded by expected losses for the currency position (portfolio) with given probability (confidence probability) during a specified time horizon in the maintaining current market conditions [10, pp. 83].

The results of the calculation of VaR are such rates as:

− absolute estimate of VaR as an amount of the possible losses of bank in the form of the reduction of the cost of open currency position and portfolio of the derivatives compared with their current market value;

− relative estimate of VaR for absolute estimate of possible losses to current value of open currency position and portfolio of the derivatives;

− estimate of capital at risk CaR (Capital at Risk) − is a multiplication of the absolute estimate of VaR and ratio of the capital coverage of risk [1, pp. 139-143].

Table 1

Comparative characteristic of methods of the quantitative estimation of the banks' currency risks

Title of a method	Advantage of a method	Disadvantage of a method
Statistical (Monte Carlo method, VaR, ETL and SRM methods)	High accuracy of determination the amount of loss and probability of its coming in the future	Necessity of the processing the high volume of statistical data
Analytical (stress-testing)	Contains the opportunities of the factor analysis of parameters	Labor-intensive
Analogies method	Actual in the impossibility of the application of other methods of analysis	It is difficult to create the conditions of repeat the past experience
Expert (Delphi method, «decision tree» method)	Effective in the absence or insufficiency of the reliable information	Subjective character
Combined method	Synergistic effect	Labor-intensive, needs to process a large amount of statistical, account and management information

Note: Completed by [7, pp. 16-17; 10, pp. 83-84]

Table 2

Comparative characteristic of methods of the calculation of VaR

Criteria	Parametric method (local estimation)		Non-parametric method (total estimation)		
	delta-normal	delta-gamma-vega approximated	historical simulations	Monte Carlo simulations	stress-testing
Adequacy to nonlinear tools	−	+	+		
Taking into account volatility	+/−		−	+	+/−
Measurement of extreme situations	−			+/−	+
Model risk	+/−		−	+	
Sample size	+/−		+	−	+/−
Computational complexity	−	+/−	+	+	+
Clearness	+	−	+	−	+
Simplisity of using	+	−	+	−	−

Note: Symbols: + yes, − no, +/− possibly or moderate

The methods for the calculation of VaR are: analitical (delta-normal, covariance-variation, parametric methods); historical modeling method (non-parametric methods); semiparametric methods (theory of extreme values and methods of maximum likelihood); Monte Carlo simulation method [6, P. 116]. The practical application of the methods of calculation of VaR is shown in works [2, pp. 131-144; 6, pp. 115-121; 15, pp. 386-388]. It gives a possibility to compare the advantages and disadvantages of these methods (table 2). The results of comparison attests that the parametric delta-normal method is simply to use, has a middle level of model risk and allows to make a local estimation of the ratio of VaR. The investigation of VaR permits to form conclusions about efficiency of risk management both for a separate currency and for a portfolio of currencies.

In 2014−2016 the significant changes had taken place on the Ukrainian currency market. In particular, sharp increasing of UAH exchange rate to major currencies had happened (fig. 1,a). Growth rate of UAH exchange rate to USD were 148,74%, 183,77% and 116,97% accordantly, UAH to EUR were 148,09%, 154,17% and 116,77%. In 2010−2016 average geometric growth rate of UAH exchange rate to USD was 121,52%, UAH to EUR was 117,90%.
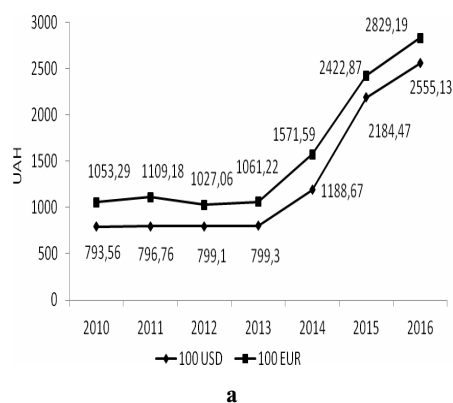
Completed by [2, P. 144; 15, P. 388]

Volatility of exchange rate had a rapid growth in 2014 (fig. 1,b). Expected average of the daily change of the exchange rate of UAH to USD was 0,0027, to EUR 0,0022. To 2016 this ratio has decreased for USD to 0,005, for EUR to 0,004. The dynamics of the average of the daily change of the exchange rate shows that both currencies had the highest level of instability in 2015 and USD was more stable than EUR.

Constructed and calculated by [8]

PJSC «PRIVATBANK» is a leader on the banking market of Ukraine by such rates of the quality of the service of customers as: quantity of cards, ATMs and terminals, part of depositors and loan users. 55,7% of all customers of deposit programs and above 26% customers who exchange currency use the services of the bank. About 21% customers of Ukrainian banks choose PRIVATBANK for the open the current account and above 15% use the services of the bank for the money transfers.

Growth of exchange rate and increasing of volatility of currencies have led to abrupt changes in the dynamics and structure of a currency portfolio. In 2012−2015 the currency portfolio decreased on 30%, in 2016 − it increased almost 7 times (fig. 2,a). Bank kept the open short currency position in both currencies. This indicates the orientation of exchange
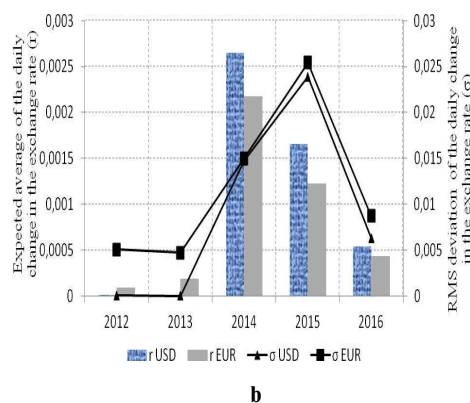

Fig. 1. Dynamics of UAH exchange rate in 2010-2016: a − UAH exchange rate; b − volatility of exchange rate
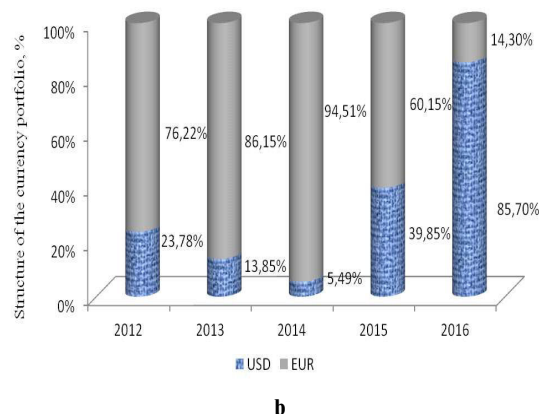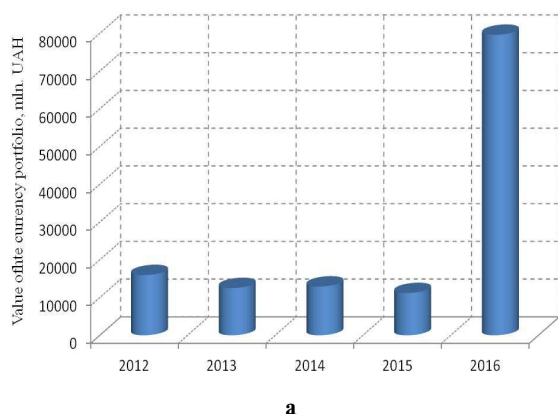

Fig. 2. Currency portfolio PJSC «PRIVATBANK» in 2012-2016: a − cost of the currency portfolio; b − structure of the currency portfolio

transactions for the purchase of foreign currency and expectation of a decline in the exchange rate. In 2014 there was a change of the currency portfolio — the part of USD decreased from 49,28% to 5,49% (fig. 2,b). In 2014—2016 the part of USD increased to 85,70%. It points to the desire of the bank to reduce the risk of a currency portfolio and its formation mainly with a more stable currency.

Constructed and calculated by [9]

By means of correlation analysis it was determined that the open currency positions of the bank for each currency and currency portfolio as a whole depend on different components of the estimation of a change of the exchange rate (table 3). So, the open currency position in USD is not depend on exchange rate and has a strong correlation with volatilities of both currencies. The open currency position in EUR has a strong correlation both with exchange rate and volatilities of both currencies. But the most it depends on the exchange rate and RMS deviation of the daily change of the exchange rate. The currency portfolio of the bank is formed in dependence on the volatilities of both currencies. The open currency positions for each currency and a currency portfolio have feedback with all components of the estimation of a change of the exchange rate.

Table 3

Correlation rates between open currency position of bank and the components of the estimate of the curency rate changes for 2012—2016

Open currency position	Currency rate		Expected average of the daily change in the exchange rate		RMS deviation of the daily change in the exchange rate	
	USD	EUR	USD	EUR	USD	EUR
USD	−0,03	−0,07	−0,90	−0,89	−0,84	−0,82
EUR	−0,80	−0,84	−0,75	−0,69	−0,83	−0,77
currency portfolio	−0,43	−0,47	−0,94	−0,90	−0,95	−0,91

Calculated by [8,9]

In 2015—2016 the bank increased the efficiency of management of the currency risk for each currency. It is shown by a significant reduction of the relative estimate of possible losses VaR from the fluctuation of exchange rate (fig. 3). The part of possible losses in the open currency position for USD decreased from 46,54% to 9,8%, for EUR — from 63,25% to 21,36%. In 2014—2016 it increased from 13,21% to 46,54% for USD and from 52,60% to 63,25% for EUR. The comparison of the relative estimates of the currency risk for each currency shows that EUR is a riskier currency than USD. That is why the decreasing of its part in the currency portfolio is expedient.
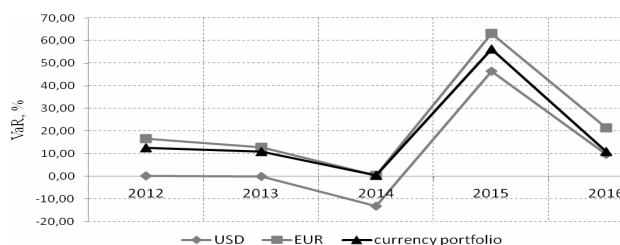

Fig. 3. Relative estimate of possible losses of the cost of a currency portfolio (VaR) from the fluctuation of exchange rates by delta-normal parametric method with probability 99%

Calculated and constructed by author

The relative estimate of possible losses from the fluctuation of exchange rates in the cost of a currency portfolio of the bank decreased from 56,29% to 10,87%. This is evidence of a reduction of risk of the currency portfolio including through the management of its structure.

So, through the increasing of the whole open currency position the bank has made effective management of the currency portfolio structure and has achieved a decline of the currency risk for each currency and currency portfolio as a whole.

The part of USD in the structure of the portfolio of currencies and the cost of the portfolio has the most impact on the level of the possible losses of the cost of the currency portfolio. Their correlation rates are 0,95 and 0,75 accordingly.

Thereby, the bank must take into account the volatilities of both currencies in the formation of the cost of the portfolio «USD-EUR» and give the main attention to the part of the USD in the management of the portfolio structure.

Conclusions

The scientific and practical reccomdations for the formation of the cost and structure of the bank's currency portfolio «USD-EUR» with taking into account the level of risk of currency fluctuations were elaborated. The nessesity of the calculation of «value at risk» for quantitative estimation of currency risk have been gronded because it's dynamics shows the state of risk-management efficiency both of separate currensy and the portfolio of currencies. It has been proved that EUR is more risky currency that USD and costs of currency portfolio and currency position in USD are formed depending on the volatilities of both currencies but the cost of currency position in EUR is formed depending on the exange rate and this volatilities. It has been determined that USD is the main currency because the level of portfolio risk depends on it's part in the structure of the portfolio.

The directions of further researchers are: the formation of the factor models of the impact of the components of estimate of risk on the level of an open currency position of the bank and the determination of areas of development of the bank

on the currency market in conditions of currency rates fluctuations.

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ОЦІНЮВАННЯ РИЗИКУ ДІЯЛЬНОСТІ БАНКУ НА ВАЛЮТНОМУ РИНКУ

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Статтю присвячено розробці науково-практичних рекомендацій щодо формування вартості та структури валютного портфеля банку залежно від рівня ризику коливання курсів валют. Зазначено, що при формуванні валютного портфеля доцільно враховувати динаміку оцінювання ризиків валют, що входять у його склад. Виокремлено основні підходи до визначення поняття «валютний ризик». Сформовано порівняльну характеристику методів оцінювання валютного ризику: статистичного, експертного, аналітичного, аналогій та комбінованого. Визначено, що результатом розрахунку «вартості під ризиком» (VaR) є показники: абсолютне оцінювання VaR, відносне оцінювання VaR, оцінювання капіталу під ризиком CaR. Класифіковано методи, які використовуються для оцінювання VaR: аналітичні (дельта-нормальний, коваріаційно-варіаційний, параметричні методи); метод історичного моделювання (непараметричні методи); напівпараметричні методи (теорія екстремальних значень і методи максимальної правдоподібності); метод симуляцій Монте-Карло. Сформовано порівняльну характеристику даних методів за критеріями: адекватність нелінійним інструментам, врахування волатильностей, вимір екстремальних ситуацій, модельний ризик, обсяг вибірки, обчислювальна складність, наочність, простота використання. Досліджено динаміку та волатильність курсів долара США та євро за 2010-2016 рр. на валютному ринку України. Проаналізовано динаміку та структуру валютного портфеля ПАТ КБ «ПРИВАТБАНК» за 2012-2016 рр. За допомогою кореляційного аналізу визначено зв'язок між відкритою валютною позицією банку та складовими оцінювання змін валютного курсу з кожної з валют та по валютному портфелю в цілому. Отримано відносну оцінювання VaR валютного портфеля ПАТ КБ «ПРИВАТБАНК» за 2012-2016 рр. дельта-нормальним параметричним методом з ймовірністю 99%. Визначено кореляційний зв'язок між VaR і структурою та вартістю валютного потфеля.

Ключові слова: валютний ризик, валютний курс, волатильність валютного курсу, вартість під ризиком, параметричний дельта-нормальний метод, портфель валют.

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ОЦЕНКА РИСКА ДЕЯТЕЛЬНОСТИ БАНКА НА ВАЛЮТНОМ РЫНКЕ

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Статья посвящена разработке научно-практических рекомендаций по формированию стоимости и структуры валютного портфеля банка в зависимости от уровня риска колебания курсов валют. Отмечено, что при формировании валютного портфеля целесообразно учитывать динамику оценок рисков валют, из которых он состоит. Выделены основные подходы к определению понятия «валютный риск». Сформирована сравнительная характеристика методов оценки валютного риска: статистического, экспертного, аналитического, аналогий и комбинированного. Определено, что результатом расчета «стоимости под риском» (VaR) являются показатели: абсолютная оценка VaR, относительная оценка VaR, оценка капитала под риском CaR. Классифицированы методы, которые используются для оценки VaR: аналитические (дельта-нормальный, ковариационно-вариационный, параметрические методы); метод исторического моделирования (непараметрические методы); полупараметрические методы (теория экстремальных значений и методы максимальной правдоподобности); метод симуляций Монте-Карло. Сформирована сравнительная характеристика указанных методов по критериям: адекватность нелинейным инструментам, учет волатильностей, измерение экстремальных ситуаций, модельный риск, объем выборки, вычислительная сложность, наглядность, простота использования. Исследована динамика и волатильность курсов доллара США и евро за 2010-2016 гг. на валютном рынке Украины. Проанализирована динамика и структура валютного портфеля ПАО КБ «ПРИВАТБАНК» за 2012-2016 гг. С помощью корреляционного анализа определена связь между открытой валютной позицией банка составляющими оценки изменений валютного курса по каждой из валют и по валютному портфелю в целом. Получена относительная оценка VaR валютного портфеля ПАО КБ «ПРИВАТБАНК» за 2012-2016 гг. дельта-нормальным параметрическим методом с вероятностью 99%. Определена корреляционная связь между VaR и структурой и стоимостью валютного портфеля.

Ключевые слова: валютный риск, валютный курс, волатильность валютного курса, стоимость под риском, параметрический дельта-нормальный метод, портфель валют.