наукомістких виробництв, з обліком того, що провідне місце в економіці країни займає важка промисловість.

Ключові слова: економічні реформи, зовнішньоекономічні зв'язки, національний фондовий ринок, глобальна криза, економічна стратегія.

РЕЗЮМЕ

В статье определены изменения в структуре народного хозяйства Китая, произошедшие в результате процесса реформирования китайской экономики: рост сельскохозяйственного производства, значительное увеличение доли сферы услуг, сдвиг в сторону увеличения доли наукоемких производств, с учетом того, что ведущее место в экономике страны занимает тяжелая промышленность.

Ключевые слова: экономические реформы, внешнеэкономические связи, национальный фондовый рынок, глобальный кризис, экономическая стратегия.

SUMMARY

In article certain change in the structure of national economy China, happenings as a result of process reformations of the Chinese economy: growth of agricultural production, considerable increase of sphere services, taking to account that a leading place in the economy of country occupies heavy industry.

Key words: economic reforms, external economic connections, national fund market, global crisis, economic strategy.

MATHEMATICAL MODELING OF COMMERCIAL BANKS LOAN PORTFOLIO

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One of the necessary preconditions for the sustainable development of any country is ensuring stability of country's financial system. Without this there would be impossible to create a favorable investment environment. In the modern financial system commercial banks have so great significance that it is necessary to pay particular attention on the evaluation of functions and activities of its main areas.

Commercial banks play an important role in the financial system and the economy. As a key component of the financial system, banks allocate funds from savers to borrowers in an efficient manner. They provide specialized financial services, which reduce the cost of obtaining information about both savings and borrowing opportunities. These financial services help to make the overall economy more efficient. Talking about modern commercial banks, it is necessary to emphasize that as well as the other structures of financial system, commercial banks are in constant development stage, too.

In general, banks are the blood vessels in the economy. Banks operate by borrowing funds-usually by accepting deposits or by borrowing in the money markets. Banks borrow from individuals, businesses, financial institutions, and governments with surplus funds (savings). Then they use those deposits and borrowed funds (liabilities of the bank) to make loans or to purchase securities (assets of the bank). Banks make these loans to businesses, other financial institutions, individuals, and governments (that need the funds for investments or other purposes). Interest rates provide the price signals for borrowers, lenders, and banks.

The main functions of commercial banks are accepting deposits from the public and advancing them loans. However, besides these functions there are many other functions which banks perform.

All these functions can be divided under the following heads:
1. Accepting deposits
2. Giving loans
3. Overdraft
4. Discounting of Bills of Exchange
5. Investment of Funds
6. Agency Functions
7. Miscellaneous Functions

Coming to the loan market, buying and selling stocks, as well as providing clients with financial account services, banks always control their liabilities. On the other hand, if resources entry to banks is delayed, or don't provide a full implementation of the requirements, banks would review their policies of asset operations [1]. Consequently, commercial banks assets and liabilities closely connected with each other.

The issue of this research is to propose effective methods of modeling of loans portfolio time series trough research of operations connected with assets and liabilities. The solution of nominated issue requires proposing such quantitative evaluation of banks' loans time-series, due to which will be implemented some measures aimed at the ensuring of the commercial banks' risk restraining and financial system. The most important component of banking is risk management.

In models of quantitative evaluation of banking time-series the mutual communication between debit and credit operations has a great importance. Management of assets' and liabilities' portfolios enables banks to improve their financial indicators, to organize the interrelation between the customers right, to strengthen the competitive position in the market [2].

There is also presented the modeling of bank's main profitable assets approximation with Fourier-Series in this article. Particularly, the main profitable assets are the loans given physical or juridical entities. The banks, which receive the majority of their profit from loans, should keep a special attention on proper management of loan portfolio [3].

To quantitative evaluation of loan portfolio time-series we are using the following methods
- Discovery the dependence between bank's loan portfolio time-series and bank's deposits and capital and then due to this approximate loan portfolio.
- Modeling bank's loan portfolio using Fourier-Series approximation [4].

As a commercial bank credit portfolio, we can pick up any data of bank and use them for analysis. In this research there is taken "Converse Bank" CJSC quarterly loan portfolio, which is operating in Republic of Armenia. The loan portfolio is for period from 31.12.2002-31.09.2012. Used time-series length is 40. See Graph 1. [5]

To building the first model we are doing a regression analyze , which aims to find out how bank's loans depend on involved deposits and capital of banks [6]. Built model will show the probable dependence between these variables.
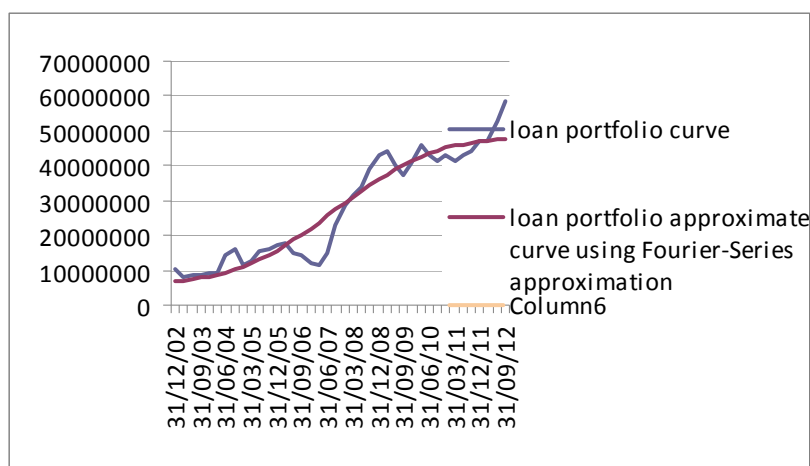
Make the following appointments:
CRED- credit portfolio value (dependent variable)
DEP- deposit portfolio (independent variable)
CAP- equity capital (independent variable)

Graph 1. Loan portfolio of "Converse Bank" CJSC from 31.12.2002-31.09.2012

The model would look like this:

$$CRED=b_0+b_1*DEP+b_2*CAP +\varepsilon_i$$

The estimated model would look like this[1]:

$$CRED= -2827467.6+2.018 *DEP+0.251 *CAP$$

Results of analysis show that the model and the variables are significant. Therefore we can rely on these results and do correct conclusions. Model dependent variables more than 85.8 % are explained by the independent variables, as the Adjusted R-squared = 0.858. So we can conclude that the bank provides loans mainly at the expense of attracted deposits and equity capital.

1% change in the deposit portfolio cause 2,018% change of the loans, and 1% change in equity capital leads to 0.251% change of loans. It is important to concentrate on the fact that the loans dependence on deposits is greater than on equity capital.

Viewing on the appearance of loan portfolio, the next model is built trough Fourier-Series, assuming that this model is the best way to approximate the loan portfolio time-series. The modeling strategy is based on a Fourier approximation in that it uses trigonometric functions to approximate the unknown functional form. The choice of the Fourier approximation as the method for modeling the time-varying intercept is driven by two major considerations. First, it is well-known that a Fourier approximation can capture the variation in any absolutely integrable function of time. Moreover, there is increasing awareness that structural change may often be gradual and smooth, rather than the sudden and discrete changes that are usually modeled by conventional dummy variables. As will become apparent, the Fourier approximation is particularly adept at modeling this kind of time variation. Second, the Fourier approach needs no prior information concerning the actual form of the time-varying intercept [4].

This model is used, because often liner regression models are not able to approximate time-series. The model would look like this:

$$CRED= b_0+b_1*sin2\pi K_1*t/T+b_2*sin2\pi K_2 *t/T+ \varepsilon_i$$

The estimated model would look like this:

$$CRED=6.532E6-4.977E6*sin2\pi K_1*t/T +1.331E8*sin2\pi K_2 *t/T$$

In this model K represents a particular frequency, T is the number of usable observations, that is, the length of the time series (here it is 40), t is time, K_1 and K_2 are frequencies with the empirical form were respectively taken 0.05 and 1.

The results of observation are showing that the approximation through the Fourier-Series, when the frequencies are different, is the best way to approximate the time-series of Converse Bank loan portfolio. The model and the variables are significant.

95.6 % of this bank loan portfolio is explained due to trigonometric trend (Fourier-Series approximation). It means that Adjusted R-Squared is 0.956.

The next important step, which is followed from the last analysis, is the frequency analysis of banking time-series. It is known, that the variables that we are dealing with, may be divided into various components in the economic analysis. As an example, many economic variables are often presented as trends, cycles as well as random errors. However such representation is somewhat difficulty explainable.

If we present graphically any macroeconomic variable, we would see that it is data around rising curve. These data have some variations, and there are also a lot of "quick" variations. The difficulty of presenting macroeconomic indicators through trends, seasonality, cycles and random errors are mainly connected with the restrictions of data. There is a need of long term time-series, which is often not available to the researcher. Relatively the new approach is the approximation of macro and micro indicators through trigonometric functions. The approach is based on the hypothesis that trigonometric trends absorb those variations, and the observed time-series can be divided into sinusoids or coincides.

An attempt was made to calculate the cycle length, which has a great contribution to the formation of the credit portfolio. The arguments of sinuses are respectively showing the high and low frequencies. K_1 and K_2 are different form each other: K_1=0.05, K_2=1.

Then is calculating values of $b_1*sin2\pi K_1 *t/T$ and $b_2* sin2\pi K_2 *t/T$ for cases t=0 and t=2 [7]. Calculating the results we obtain that the percentage influence of the low frequency during the loan portfolio formation is grater then the percentage influence of the high frequency. The low frequency influence on loan portfolio is almost 99 %.

If 2π turns to T quarter, then $2\pi K_1/T$ will be X_1 quarter, and the $2\pi K_2/T$ will be X_2 quarter. From the results of calculations we get that X_1=0.05 and X_2=1. So we have shown that the quarterly repeating cycle during the crediting process has greater contribution to the loan portfolio formation, than 0.05 quarterly repeating processes. Thus, having specific frequencies we can reveal the frequency which influence will be greater in total.

Such analysis can be performed by any commercial bank, which will enable the bank to reduce the risk, to do right diversification of assets, to ensure sufficient liquidity and to improve the risk management systems due to the accurate predictions. The research results will be useful for any commercial banks operating in countries with transition economy, including Ukraine. The results of research will also have significance in educational process, as well as in increasing the role of mathematical sciences in banks' risk management process.

СПИСОК ИСТОЧНИКОВ
1. Banking, Bagrat Asatryan, Yerevan 2004
2. Formation of Optimal Credit Portfolio and Designing of Model of Creditworthiness Analysis, R.A. Avetisyan, A.S. Khachatryan, Yerevan 2001: RA

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[1] The evaluation of models were done using SPSS package.

National Academy of Sciences, Publishing "Gitutyun", pp 72-73
3. Banking and Basics of Monetary Circulation/ part 1, R.A. Avetisyan, A.S. Khachatryan, SEUA, Yerevan 2005, pg.
4. Modeling Inflation and Money demand Using a Fourier-Series Approximation, Ralf Becker, Walter Enders and Stan Hurn, April 20,2005
5. www.conversebank.am
6. Basic Econometrics , Damodar N. Gujarati,United States Military Academy, West point, 4th edition
7. Spectral Analysis of Economic Time Series. C. W. J. Granger, M. Hatanaka, 1964 Princeton University Press, pp 62-67

РЕЗЮМЕ

Враховуючи важливість фінансової системи у сталому розвитку країни, роль комерційних банків у фінансовій системі в дослідженні були пред'явлені такі моделі, які можуть допомогти розкрити зв'язки між активом та пасивом комерційних банків і виконати оцінку загальної суми кредитного портфеля. Дослідження можна застосувати до будь-якого банку, ця розробка допомагає управляти банківськими ризиками та сприяти стабільності фінансової системи країн.

Ключові слова: Фінансова система, комерційні банки, активи, пасиви, депозити, кредити, моделювання, ряд Фур'є наближення, регресійний аналіз, тригонометричні функції, частотний аналіз, тенденції, управління ризиками.

РЕЗЮМЕ

Принимая во внимание важность финансовой системы в устойчивом развитии страны, роль коммерческих банков в финансовой системе в исследование, были предъявлены такие модели, которые могут помочь раскрыть связи между активом и пассивом коммерческих банков и выполнить оценку общей суммы кредитного портфеля. Исследование применимо к любому банку и помогает управлять банковскими рисками и способствовать стабильности финансовой системы стран.

Ключевые слова: Финансовая система, коммерческие банки, активы, пассивы, депозиты, кредиты, моделирования, ряд Фурье приближения, регрессионный анализ, тригонометрические функции, частотный анализ, тенденции, управление рисками.

SUMMARY

In the research were considered the importance of financial system during the sustainable development of the county and the role of commercial banks in the financial system. Also were charged such models, which could help to reveal the connection between commercial bank's assets and liabilities and to do the evaluation of loan portfolio. The research is applicable to any bank, it helps to manage banking risks and to contribute the financial system stability of country.

Key words: Financial system, commercial banks, assets, liabilities, deposits, loans, modeling, Fourier-Series approximation, regression analyze, trigonometric functions, frequency analysis, trends, risk management.

EFFECTS OF INCENTIVES ON FOREIGN DIRECT INVESTMENT

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In this research we will discuss the factors that effects on foreign direct investment. We will take incentives, especially tax incentives from those factors, discuss and analyze whether it has significant effect on foreign direct investments or not, also we will discuss how to increase the investments of regions.

Foreign Direct Investment is very important and has significant effect on the development of any nation. Especially Foreign Direct Investment is more important for underdeveloped or developing countries. These types of countries' economies have both the demand for a good or service, and the labor and natural resources to supply it, and do not have the needed level of savings and income in order to meet the required level of investment for sustain the growth of economy. In this type of cases foreign direct investment plays an important role of bridging the gap between the available resources or funds.

So, in order to attract such investments the governments of such economies must make their policies more investor friendly. For making the economy more investor friendly we should understand what factors mainly effect on foreign direct investment. There are many factors those effects on foreign direct investment let's look majors from them [1]:

- Incentives
- Openness
- Infrastructure
- Productivity and workforce skills
- Cost factors
- Market size

Cost factors: The major cost factor is the labor cost. Labor cost forms a major margin of total product cost of many countries. Hence multinational corporations try to find economies in which there exist cheaper labor costs. This is reason why many manufacturing and services companies usually invest in countries like India or China which have cheap labor. The other major cost factor is cost of raw material, which also like labor cost is huge part of total product's cost. Transportation cost also adds much to the total cost. The other cost factor is cost of pollution, some countries like EU countries are very strict according to environment pollution and others are not paying attention on that and in manufacturing activities more environment friendly production costs money for investors.

Market size: Market size effects on foreign direct investment and there is a strong correlation between the size of the domestic markets and the FDI that these countries attract. This is because investment must justify the returns which are to be derived through sales made with in the country.

Infrastructure: Infrastructure of any economy is important for the trade and commerce development. To attract foreign direct investment the country should have adequate system of transportation like roadways, railways, ports, airports, and power, water supply, warehouses and other kinds of infrastructures. Foreign investors look and see whether such infrastructure exists so that business can carry on smoothly otherwise bad infrastructure may lead to problems related to supply chain and manufacturing which may then ultimately lead to prohibitive cost structures.

Openness: Host country must set such policies that are open and investor friendly. Foreign investors must be able to freely setup facilities without much governmental hassles. Also, the home country must be freely reached the profits, dividends and gains made from operation during a year within the country.

Productivity and workforce skills: Productivity and workforce skills directly effects on the rate of return of investments. The education and skills of employees are effecting on productivity, so those factors can be increased providing good education within the country.

As we discussed there are many factors that influence on foreign direct investment. Let's take incentives and see is it right to concentrate on incentives for attracting foreign direct investments.

Incentives: Considering Incentives as a factor in attracting FDI, these are secondary to more fundamental Determinants, such as market size, access to raw materials and availability of skilled labor. In some cases, and with some types of investment, however, their impact may be more pronounced. For some foreign investors, such as footloose, export-oriented investors, tax incentives can be a major factor in their investment location