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COMPARATIVE ANALYSIS OF PROFITABILITY OF COMMERCIAL BANKS

The application of the DuPont model for the study of bank performance assessment is discussed. Return on assets and financial leverage multiplier are analyzed to produce return on equity. According to the activity of Armenian commercial banks, financial time series are used as data for the assessment of return on assets and financial leverage multiplier. It is shown that the regression dependence of return on equity from return on assets and financial leverage multiplier is significant. The panel analysis implemented for Armenian commercial banks using the DuPont regression model allowed for the analysis of financial indicators assessing the banks' activity.

Key words: bank, return, assets, equity, financial leverage multiplier, DuPont, panel analysis.

Introduction.

Present paper is devoted to the study of the profitability of the system of financial institutions using the DuPont model of financial analysis given in (8). Works using various methods of analysis and, in particular, based on the application of the DuPont model, are devoted to studying the activities of the system of financial institutions in order to study their profitability and efficiency. The paper uses the approach of the multiple regression modeling of Du Pont method (Acikgoz Turker, Fidan Arzu, 2023) “with a well-known econometric method, panel data analysis” for the assessment of the efficiency Armenian commercial banks. The effectiveness of the DuPont model is explained by the fact that it allows to measure the effectiveness of return on equity (ROE) depending on the return on assets (ROA) and financial leverage multiplier (FLM). Financial information about the bank's activities is available in the bank's reports provided on the bank's web page. The work provides sources of quarterly information on the bank's activities, as well as the nature of changes in the determinants characterizing the bank's financial activities.

Literature review

The goal of a commercial bank, similar to the objectives of any company, is to make a profit in conditions of market competition. The effective management of a commercial bank requires the adjustment and maintenance of an efficient accounting and financial system. In the context of improving these systems, the degree of return on assets and capital in financial analysis increases. The currently existing DuPont analysis system (hereinafter referred to as the DuPont model) has proven its significance in assessing the performance of corporations, and in particular, commercial banks, based on an assessment of return on assets and capital.

The model allows us to study the dynamics of fluctuations in the company's key indicators (Bakanov, Sheremet, 1998). However, analyzing individual indicators does not provide a complete picture of the financial condition of the organization. A company's financial analyst is responsible not only for assessing changes in the values of financial indicators but also for determining and predicting the behavior of these indicators to assess the bank's performance for decision-making purposes and potential problem-solving. This analysis should consider the specifics of the organization and involve a comprehensive joint analysis of indicators.

The idea of this type of analysis originated in 1919 from specialists at the DuPont Corporation. The financial analysis diagram shows the relationship between the organization's profitability indicators, known as the DuPont model. The DuPont analysis system enables a comprehensive approach to solving the problem of increasing a bank's efficiency by studying the efficiency of the company's assets.

The analysis system based on the application of the DuPont model divides return on assets into sections that impact profitability. The analysis is conducted by evaluating the coefficients obtained through the calculation process. The indicator that has the greatest impact on profitability is identified, and the forecast for maximizing the organization's profit is based on it (Van Horn, 1996).

Theoretical Basis

DuPont financial analysis model

The model is based on a simple formula for estimating return on assets.

$$\text{Return on Assets} = \text{Profit} / \text{Assets} \quad (1)$$

We get the second part of the equation by multiplying and dividing by income to get

$$\text{Asset Profit} = (\text{Original Profit}) / (\text{Financial Leverage Multiplier}) \quad (2)$$

This equation is the well-known as Du Pont model (Economic analysis of bank activities, 1996):

This model allows us to find the relationship between its components and achieve a greater increase in return on assets, and you also find what had a great impact on return on assets:

- Increase or decrease in profitability of sales,
- Fast or slow turnover of assets used,
- Both factors together.

Thus, we find that the reason for the decrease in return on assets can be either one or another factor. Since the profitability of sales depends on the price and the amount of expenses, it is possible to analyze why it increases or decreases. By considering the results of previous years, it is possible to determine what is more important for the organization: price increases or more efficient asset management.

Return on assets can be managed using both return on sales and asset turnover. Thus, in conditions of passive turnover of assets, their profitability can be increased due to prices or due to the cost of production. In conditions of low return on

sales, the capital turnover rate should be increased.

All coefficients are correlated. As can be seen from equation (2), profitability depends on the turnover ratio, so the growth of profitability is stimulated by a reduction in assets.

Reduction of assets can be achieved by reducing current assets. To do this, you need to consider the following options:

- sale or write-off of unused or inefficiently used equipment, reduction of non-productive assets,
- reduction of raw materials and materials,
- reduction of accounts receivable.

Lack of liquidity should also be taken into account when managing your own turnover. A choice must be made between reducing current assets, which has a positive effect on return on assets, and reducing the overall lack of liquidity, which can lead borrowers to the problem of non-repayment. When studying this relationship, the degree of impact should be checked every year for further more detailed analysis. By studying its dynamics, you can find the stage of its deterioration and, based on indicators, find out what led to this. Thus, you can come to the initial areas of deterioration and try to modify them.

For partial cost-benefit analysis, the general DuPont analysis model is used, derived in a similar manner but determined by three factors.

The model is based on a simple return on assets formula.

$$\text{Return on Assets} = \text{Profit} / \text{Assets} \tag{3}$$

Multiplying the second part of the equation by dividing by income and also by capital, we get

$$\text{Return on assets} = (\text{Profit/Assets}) * (\text{Income/Income}) * (\text{Shared capital/Shared capital})$$

Consequently we have:

$$\text{Return on assets} = \text{Return on sales} * \text{Financial Leverage Multiplier} * \text{Autonomy coefficient} \quad (\text{Chetyrkin E. M. (1995)}).$$

Thus, this multifactor model allows us to determine which of these factors changes the return on assets depending on the results of effective management of available resources, profitability, rational use of capital, or as a result of their total change. The use of one model or another depends on how detailed the research needs to be. In a similar way, you can construct a 2- or 3-factor analysis of capital.

$$\text{Return on Equity} = \text{Profit/September. Capital:}$$

Multiplying and dividing by income, we get

$$\text{Return on Equity} = \text{Profit/Revenue} *$$

$$\text{Income/Capital} = \text{Return on sales} * \text{Equity turnover ratio.}$$

This formula gives the possibility to determine factors influencing the return on equity.

- Increase or decrease in profitability of sales
- Acceleration or deceleration of capital turnover

- Both factors together

Modified three-factor model.

Return on Equity = Profit/Capital:

Multiplying and dividing by Income, as well as assets, we get

Return on Equity = Profit/Revenue *Income/assets *Assets/capital = return on sales * asset turnover ratio * financial leverage multiplier.

As is known, the higher the return on equity, the better. However, as can be seen from the DuPont model, high rates can be achieved due to excess debt capital and low equity capital, which negatively affects the financial stability of the organization. This is a fundamental rule of business.

From the modified multifactor model it is clearly seen that the organization's return on equity and its financial stability are inversely relative values. Increasing equity capital increases the financial stability of the organization, but reduces return on capital.

The return on equity ratio makes sense only when the organization has working capital, i.e. positive assets. Otherwise, the calculations give negative values, which is not suitable for analysis.

From the modified return on assets and return on equity, you can determine how these three factors affect the company's profitability:

- Sales profitability,
- Turnover,
- Financial decisions.

The DuPont equation can be used to analyze the financial condition of business entities; it makes it possible to assess the entity's pricing policy, expenses, and the degree of use of assets and debts. It can also be used to find the best way to make a structure profitable (Financial management, 1996).

For each specific case, the model takes into account the factor that has the greatest impact on return on equity. From the model described above, it can be seen that return on equity depends on three factors:

- Sales profitability,
- Asset turnover in the course of business activities,
- Expanded capital structure,
- Three factors together.

DuPont's equations estimate return on equity based on net income, gross assets and leverage (Ahmed Arif Almazar, 2012). The purpose of this work is to present the financial management model of the operating organization based on regression analysis.

Research Methodology

In this study, we analyzed financial indicators to assess the operating efficiency of commercial banks in Armenia using the DuPont analysis method. We used the following three components of

DuPont Analysis: ROE, ROA, and FLM efficiency factors. Based on these indicators, an analysis was performed using a regression model to assess the degree of influence of return on assets and financial leverage multiplier on return on capital. The time series of the studied variables consisted of quarterly data from 16 Armenian commercial banks during 2011–2023. Data were collected based on quarterly financial statements presented on the commercial bank’s web page.

Research models

Determinants of the DuPont model characterizing bank activities

The variables were studied as determinants for the bank activity assessment. Basic definitions and notations are used from Shirgba Timothy A., (2022).

Definition 1. The variable that determines the level of profitability of the bank (ROA) and its ability to generate profit is used as one of the main variables of the DuPont model. To measure the after-tax income that a company receives, it is used as an estimate of after-tax return on assets.

$ROA = \text{Net Income} / \text{Average Assets}$ or $ROA = \text{Net Income} / \text{End of Period Assets}$

Definition 2. The variable, which allows to evaluate the efficiency of the bank’s use of its own corporate funds (ROE) Return on Equity measures the return on investment:

$ROE = \text{Net Income} / \text{Shareholders' Equity}$

Definition 3. The financial leverage multiplier (FLM) allows to assess the amount of risk that a financial institution poses to creditors. By definition, the FLM equity multiple allows lenders and investors to determine how leveraged an organization is. The formula for the financial leverage multiplier (FLM) is calculated as follows:

$\text{Equity Multiplier} = \text{Total Assets} / \text{Total Shareholders' Equity}$

Let’s study the return on equity (Shirgba Timothy A., 2022), (Sokolov, 1996) model, which represents the dependence of the return on equity ratio on the following three factors: profit margin, asset turnover and financial leverage. Using the definitions, we will get:

$$ROA = \frac{\text{netprofitaftertax}}{\text{onlyassets}} \tag{4}$$

$$FLM = \frac{\text{onlyassets}}{\text{equity}} \tag{5}$$

$$ROE = \frac{\text{netprofitaftertax}}{\text{equity}} \tag{6}$$

From equations (4)-(6) follows:

$$ROE = ROA * FLM : \tag{7}$$

Theoretically, the ROE factor can be represented by two ratios:

Net profit margin and capital turnover are based on the results of the work (Gitman, 1998), (Collier, McGowan, Junaina Muhammad, 2010).

The Du Pont model allows to predict the financial condition of an organization based on regression analysis. To conduct the research the following Du Pont regression model was used (Acikgoz Turker, Fidan Arzu, 2023):

$$ROE_t = \alpha_0 + \alpha_1 ROA_t + \alpha_2 FLM_t, \tag{8}$$

where ROE- return of capital, ROA- return of assets, FLM financial leverage multiplier.

Let us denote as the $cor(ROA, FLM)$ correlation coefficient between ROA and FLM. The calculation of the $cor(ROA, FLM)$ of Armenian banks is given in the Table 1.

Table 1 shows the correlation coefficients between the ROA and FLM variables of 16 Armenian commercial banks. The values of $cor(ROA, FLM)$, depending of the bank, are either negative or positive, but necessarily have a small value. This indicates that the degree of correlation between ROA and FLM is low.

Table 1. Correlation coefficients for model 1

	1	2	3	4	5	6	7	8
Bank	Ardshinbank	IdBank	ACBA	Byblos	Artsakh	VTB	Ararat	AEB
$Cor(ROA, FLM)$	-0.0599	0.01884	0.108068	-0.069	-0.014841	-0.0681	-0.0347	0.0172

Continuation of table 1

	9	10	11	12	13	14	15	16
Bank	ArmSwis	Converse	Ineco	Ararat	Evoca	Ameria	HSBC	Unibank
$Cor(ROA, FLM)$	0.16574	0.06211	-0.1644	0.17983	-0.0793	-0.1362	-0.0618	0.0381

Using a time series, a regression equation can be developed whose regression coefficients allow us to estimate the impact of financial leverage and return on assets on return on equity. Thus, the DuPont model is a financial tool that can be used to analyze financial and economic time series. In other words, changes in ROA and ROE over a short period of time can be assessed, as well as the impact of ROA and FLM on ROE.

The main advantage of the DuPont model is its simplicity. The significance of this model is that it allows us to estimate the correlation of key variables. At the same time, it makes it possible to evaluate the impact of a change in one variable on another variable.

Thus, the DuPont model is a financial tool that can be used to analyze financial and economic time series. In other words, changes in ROA and ROE can be assessed over a short period of time (Henry W. Collier, Carl B. McGowan, Jr., Junaina Muhammad, 2010).

Scenario analysis

Scenario analysis based on the DuPont regression model (8) was carried out for the purpose of financial analysis and identifying the degree of influence of shocks ROA and FLM on return on equity. An analysis of DuPont models of 16 commercial banks operating in the Republic of Armenia for the period 2011–2023 showed the following.

The degree of influence of ROA and FLM on ROE differs between banks. The sensitivity of ROE to changes in ROA and FLM showed the following. An analysis of the financial sensitivity of return on equity ROE depending on changes in ROA and FLM, carried out within certain limits, made it possible to compare sensitivity of ROE to changes from ROA and FLM.

An analysis of situations involving shocks to ROA and FLM on return on equity was carried out. The results of the analysis of the sensitivity of 16 commercial banks operating in the Republic of Armenia for the period 2011–2023 to ROA and FLM shocks are different from each other.

Results

Panel analysis of Armenian commercial banks

Panel analysis of the DuPont model of commercial banks allowed to implement cross-banking analysis of 14 commercial banks operating in the Republic of Armenia for the period 2011–2023.

The regression and panel analysis models are given in the tables 2 and 3.

Table 2. Du Pont regression models of rmenian commercial banks

Ardshin			Unibank			HSBC			VTB			IDbank			
	a2	a1	a0	a2	a1	a0	a2	a1	a0	a2	a1	a0	a2	a1	a0
coeff	0.005576	8.432699	-0.04722	0.002171	7.457391	-0.01564	0.005156	5.152899	-0.02667	0.002587	4.76929	-0.01276	0.002587	4.76929	-0.01276
st.error	0.000414	0.233754	0.003602	0.000218	0.115359	0.00156	0.000775	0.051946	0.004056	0.000707	0.236624	0.005439	0.000707	0.236624	0.005439
R ²	0.964916	0.00633	#N/A	0.989149	0.002157	#N/A	0.997973	0.000854	#N/A	0.904164	0.007047	#N/A	0.904164	0.007047	#N/A
F.stat	715.0759	52	#N/A	2370.099	52	#N/A	4923.606	20	#N/A	245.2965	52	#N/A	245.2965	52	#N/A
	0.057301	0.002083	#N/A	0.022063	0.000242	#N/A	0.007182	1.46E-05	#N/A	0.024365	0.002583	#N/A	0.024365	0.002583	#N/A
t-student	13.48274	36.07516	-13.108	9.944949	64.64493	-10.026	6.652346	99.19655	-6.57533	3.659477	20.15556	-2.34588	3.659477	20.15556	-2.34588

Converse

	a2	a1	a0
coeff	0.004074	6.870211	-0.0277
st. error	0.000286	0.102597	0.001938
R ²	0.990147	0.002098	#N/A
F. stat	2411.724	48	#N/A
	0.021232	0.000211	#N/A
t-student	14.22693	66.96331	-14.2913

Table 3. Model of Du Pont panel analysis

	a2	a1	a0
coeff	0.00545	0.11065	0.2422
St.error	0.005547	0.07497	0.0042
R ²	0.009338	0.03147	#N/A
F-stat	1.41865	301	#N/A
	0.00281	0.29812	#N/A
t-student	0.99762	1.47597	5.76993

Du Pont analysis models are given in tables 2 and 3. Du Pont regression analysis models show that the descriptive statistic R^2 is high and satisfies to the inequality $R^2 > 0.9$ and suggests that the regression model has a good fit. Consequently, the regression Du Pont models of Armenian commercial banks involve an implicit causality. Both F and t tests have high levels of significance. The Du Pont regression models could be used to predict the future level of the return of equity of Armenian commercial banks. The slope coefficients allow to measure the change in return of equity associated with a small change in the return of assets and financial leverage multiplier.

Conclusion

DuPont's financial analysis model is used in various sectors of the economy. In particular, it has shown high efficiency for assessing the efficiency of banks.

This paper is devoted to the study of factors for assessing financial indicators and profitability of the functioning of Armenian commercial banks. For this purpose, the possibility of using the DuPont regression model was studied. It is shown that analysis of bank efficiency based on the application of the DuPont analysis model can be effectively implemented. The multiple linear regression method using the approach (Acikgoz Turker, Fidan Arzu (2023)) and proposed in this study allows to assess the significance of the components of the DuPont model. The model developed in the study for assessing bank profitability using indicators of asset efficiency and financial leverage multiplier allows to determine the level at which the bank's financial indicators are located.

The study's findings indicate that the primary financial indicators determining bank performance are return on assets (ROA) and the financial leverage multiplier (FLM). The return on equity (ROE) performance indicator, derived from ROA and FLM, shows a positive impact on ROE, underscored by a high magnitude of significance. For all Armenian commercial banks analyzed, the regression equation's significance assessment was notably high ($R^2 > 0.9$).

The key contribution of this research to the field of bank performance analysis lies in demonstrating that the components of the DuPont model can effectively assess return on equity by utilizing indicators of return on assets and financial leverage multiplier. Expanding the list of indicators in the DuPont model could further enhance the assessment of a bank's profitability. Identifying and adjusting these additional variables would enable banks to achieve the desired level of return on capital, thereby optimizing their financial performance.

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Հոդվածում քննարկված է Դյու Պոնտի ռեգրեսիոն մոդելի կիրառումը բանկի գործունեության գնահատման համար: Ակտիվների արդյունավետությունը և ֆինանսական լծակի բազմապատկիչը ուսումնասիրվում են սեփական կապիտալի արդյունավետության գնահատման համար: Որպես ֆինանսական ժամանակային շարքեր օգտագործվում են Հայաստանի առևտրային բանկերի գործունեության ակտիվների եկամտաբերության և ֆինանսական լծակների բազմապատկիչի ժամանակային շարքերը: Ցույց է տրված, որ ակտիվների և ֆինանսական լծակների բազմապատկիչից կախված սեփական կապիտալի արդյունավետության ռեգրեսիոն մոդելը նշանակալի է: Հայաստանի առևտրային բանկերի համար իրականացված պանելային վերլուծությունը հիմնված DuPont ռեգրեսիոն մոդելի վրա թույլ է տվել գնահատել բանկի հիմնական կապիտալի արդյունավետությունը:

. բանկ, վերադարձ, ակտիվներ, սեփական կապիտալ, ֆինանսական լծակների բազմապատկիչ, DuPont, պանելային վերլուծություն:

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СРАВНИТЕЛЬНЫЙ АНАЛИЗ ПРИБЫЛЬНОСТИ КОММЕРЧЕСКИХ БАНКОВ

Обсуждается применение регрессионной модели Дюпона для оценки эффективности функционирования коммерческих банков Армении. Для определения доходности собственного капитала анализируются доходность активов и мультипликатор финансового рычага. В зависимости от деятельности коммерческих банков Армении финансовые временные ряды используются в качестве данных для оценки доходности активов и мультипликатора финансового рычага. Показано, что регрессионная зависимость доходности собственного капитала от доходности активов и мультипликатора финансового рычага является значимой. Панельный анализ, реализованный для коммерческих банков Армении с использованием модели DuPont, позволил реализовать анализ финансовых показателей, оценивающих деятельность банка.

Ключевые слова: банк, доходность, активы, собственный капитал, мультипликатор финансового рычага, DuPont, панельный анализ.

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