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Do Mergers Affect Stock Returns and Volatility? The Case of Merger between Ioniki-Laiki Bank and Alpha Bank

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Abstract

In the present study we approach the question whether a merger of firms affects the risk in their stocks- in what direction and how much. As special case we examine the merger of Ioniki-Laiki bank with Pisteos bank, which took place on 1-7-1999 resulting to a new entity: the Alpha bank. In particular, we examine: first the returns of each single bank stock before merger separately and in relation to the returns of the overall index and secondly the volatility of each single bank stock before merger separately and in relation to the volatility of the overall index. The findings clearly show that the new bank which resulted from the merger enjoyed a higher returns rate and a lower volatility.

Keywords: Mergers, Stock returns, Volatility, Fractal-dimensional Geometries
JEL Classification Codes: C500 – Econometric Modeling General

1. Introduction

The study of stock time series has shown that forecasting the future value of a given stock is an impossible task- and this is not to surprise. If there existed a method to forecast future values of a stock, even in a wide confidence interval, by any method- probabilistic, econometric, use of crystal ball or whatsoever, the method would sooner or later become a common knowledge and the stock exchange could not any more function as such. All studies on the stock time series converge to the conclusion that the stock course can be best described as random walk- the best forecast of tomorrow closing value is the today's closing value.

However, there is still much to do with stock time series; namely to evaluate the risk, inherent in any stock (and in any financial/speculation product). At present, the most popular methods to evaluate the stock's risk is the market model and the volatility analysis (there still exist and other methods, inspirited from chaos theory and fractal-dimensional geometries, which, at present, despite their heavy mathematical and statistical burden, yield no practically better results).

2. Methodology

For the measurement of volatility of a given stock we give the following symbols and definitions:

t: day of year

Return of stock in day t: r(t)=Ln[r(t)/r(t-1)], Ln: natural logarithm

Annual volatility: $\sigma_y = \sigma_p \sqrt{P}$

P: number of periods in a year; P=12 for monthly volatility and P=52 for weekly volatility.

σ_p: volatility of period P.

For each period the volatility is defined as the sample standard deviation of returns in the period.

The choice for the above definitions for volatility is the most popular for they suit to Black-Scholes model for pricing a European option.

In this study we have worked in terms of weekly volatility, since the time series of stock is long enough to obtain an estimate of the weekly volatility as average of the sample volatilities.

3. Data and Symbols of Variables

The data covers the period 4-11-99 to 31-12-99 and consists of:

- 250 daily observations on the overall value index of the Athens stock exchange (variable ASE)
- 122 daily observations on the closing value of the stock of IONIKI-LAIKI bank for the period 4-11-99 to 30-06-99 (variable IL)
- 122 daily observations on the closing value of the stock of PISTEOS bank for the period 4-11-99 to 30-06-99 (variable P)
- 128 daily observations on the closing value of the stock of ALPHA bank for the period 1-07-99 to 31-12-99 (variable A).

The complete sets of data and the detailed calculations are shown in the MINITAB and excel files following this file.

The symbols for the variables representing the returns of the overall index and the stocks is RET ASE, RET IL, RET P and RET A, accordingly.

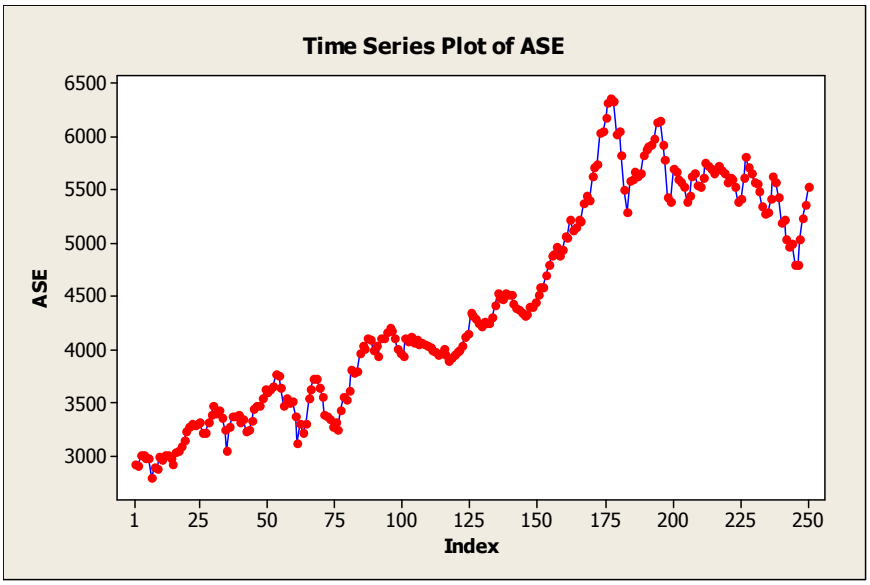
The symbol for the weekly volatility of the overall index and the stocks is VOL ASE, VOL IL, VOL P and VOL A accordingly.

4. The Analysis

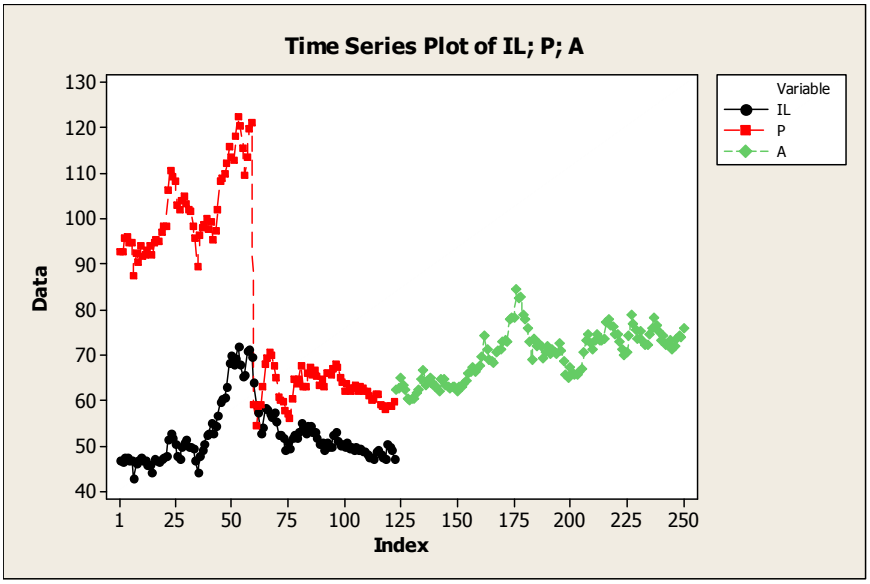
4.1. Graphs and Descriptive Statistics of ASE-IL-P-A

The following graphs 1 and 2 show the course of the closing price of the ASE and the IL, P and A stocks.

Graph 1:



Graph 2:

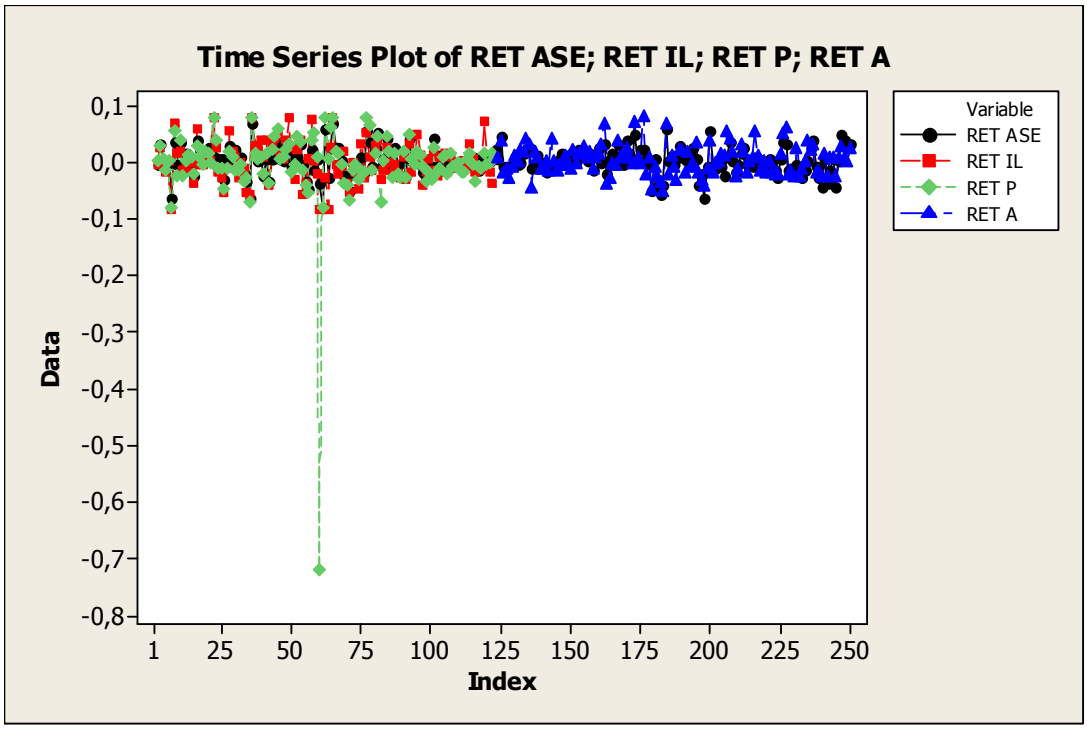


In graph 2 it is striking the rough drop of the P stock registered on 31-03-99 which reduced the closing price of the stock from 120,91 units down to 58,90. This drop is translated to a high volatility in the week in which it happened. Also, comparing the course of the stock A with this of ASE we encounter a parallel course between the new stock A and ASE.

4.2. Graph and Descriptive Statistics of Returns

In the following graph 3 are shown in compacted form the returns of ASE and the three stocks. In the graph we observe that for the stock P the shock of 31-03-99 is absorbed and the stock follow the average course along with that of ASE and IL.

Graph 3:



In relation with the returns of the stocks from the following table 1 we can draw the conclusions that: a/ the average return of P is negative and b/ after merger the return stock of A is higher than both returns of IL and P before merger, i.e. after merger both stocks are doing better.

Table 1: Descriptive Statistics: ASE; IL; P; A; RET ASE; RET IL; RET P; RET A

Variable	Mean	StDev	Minimum	Maximum
ASE	4424,3	984,9	2798,2	6355,0
IL	52,423	6,477	42,970	71,900
P	81,70	20,79	54,29	122,30
A	70,135	5,402	59,870	84,240
RET ASE	**0,00254**	**0,02359**	**-0,07900**	**0,06900**
RET IL	**0,000124**	**0,03456**	**-0,08300**	**0,07700**
RET P	**-0,00369**	**0,07321**	**-0,71900**	**0,07700**
RET A	**0,00157**	**0,02579**	**-0,05400**	**0,07700**

4.3. Correlations and Regressions

In the frame of risk analysis based to the market model we read in table 2 that the correlations of the returns of the stocks IL and P before merger with the returns of ASE were 0,720 and 508 accordingly. After merger the correlation of the new bank A with ASE has increased to 0,732, i.e. the new stock goes at least so close to ASE as before merger.

Table 2: Correlations between RET ASE; RET IL; RET P

	RET ASE	RET IL
RET IL	0,720	
	0,000	
RET P	0,508	0,508
	0,000	0,000

Pearson correlation of RET ASE and RET A = **0,732**
P-Value = 0,000

The regressions shown in table 3 are seeking to investigate the systematic risk of the stocks. From the theory of the market model it is known that the higher is the coefficient of determination in a regression of the returns of a stock versus the returns of the overall index the higher is the risk explained by the connection of the stock to the overall index. Looking in the table the highlighted coefficients of determination we see that the systematic risk is better 'explained' in the case of the new stock A (AdjR^2 =52,29%) than in the cases of the stocks IL and P (50,02% and 21,12% accordingly)

Table 3: Regressions of stocks returns versus returns of ASE

Regression Analysis: RET IL versus RET ASE

The regression equation is

RET IL = - 0,00248 + 0,989 RET ASE

Predictor	Coef	SE Coef	T	P
Constant	-0,002476	0,002202	-1,12	0,263
RET ASE	0,98932	0,08742	11,32	0,000

S = 0,0240863 R-Sq = 51,8% R-Sq(adj) = 51,4%

PRESS = 0,0716334 **R-Sq(pred) = 50,02%**

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0,074294	0,074294	128,06	0,000
Residual Error	119	0,069038	0,000580		
Total	**120**	**0,143331**			

Durbin-Watson statistic = 1,47485

Regression Analysis: RET P versus RET ASE

The regression equation is

RET P = - 0,00757 + 1,48 RET ASE

Predictor	Coef	SE Coef	T	P
Constant	-0,007569	0,005790	-1,31	0,194
RET ASE	1,4775	0,2299	6,43	0,000

S = 0,0633431 R-Sq = 25,8% R-Sq(adj) = 25,1%

PRESS = 0,507328 **R-Sq(pred) = 21,12%**

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0,16570	0,16570	41,30	0,000
Residual Error	119	0,47747	0,00401		
Total	**120**	**0,64317**			

Durbin-Watson statistic = 2,10045

Regression Analysis: RET A versus RET ASE

The regression equation is

RET A = - 0,00040 + 0,854 RET ASE

Predictor	Coef	SE Coef	T	P
Constant	-0,000397	0,001573	-0,25	0,801
RET ASE	0,85418	0,07101	12,03	0,000

S = 0,0176287 R-Sq = 53,6% R-Sq(adj) = 53,3%

PRESS = 0,0399882 **R-Sq(pred) = 52,29%**

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0,044965	0,044965	144,69	0,000
Residual Error	125	0,038847	0,000311		
Total	**126**	**0,083811**			

Durbin-Watson statistic = 1,93221

4.4. ANOVA Test for Means Equality of ASE and Stock Returns

For testing the significance of the descriptive results concerning the returns of the ASE and the stocks we have applied the ANOVA technique to test equality of the ASE and stock means. To this purpose we have checked the independence of the observations in each time series using the runs test and the equality of variances using the Bartlett's test and the Levene's test for equality of variances. In the following table 4 are shown the results of the runs tests

Table 4: Runs Test: SIGN ASE; SIGN IL; SIGN P; SIGN A

Runs test for SIGN ASE
Runs above and below K = 0,550201
The observed number of runs = 102
The expected number of runs = 124,245
137 observations above K; 112 below
P-value = 0,004

Runs test for SIGN IL
Runs above and below K = 0,454545
The observed number of runs = 55
The expected number of runs = 61
55 observations above K; 66 below
P-value = 0,269

Runs test for SIGN P
Runs above and below K = 0,504132
The observed number of runs = 55
The expected number of runs = 61,4959
61 observations above K; 60 below
P-value = 0,236

Runs test for SIGN A
Runs above and below K = 0,488189
The observed number of runs = 57
The expected number of runs = 64,4646
62 observations above K; 65 below
P-value = 0,183

The tests show independence of the returns IL, P and A, while the independence of observation is rejected in the case of ASE (p-value=0,004). Besides, as shown in the graph 4 and in table 5 the equality of variances is rejected by both tests

Graph 4:

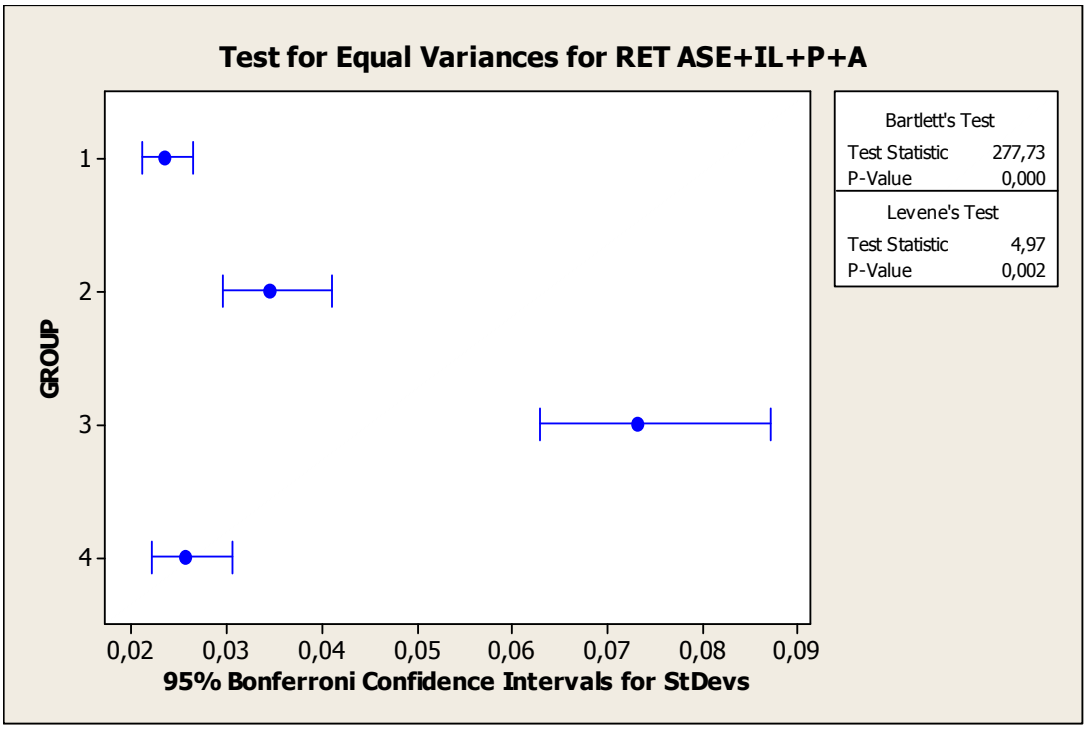


Table 5: Test for Equal Variances: RET ASE+IL+P+A versus GROUP
95% Bonferroni confidence intervals for standard deviations

GROUP	N	Lower	StDev	Upper
1	249	0,0211949	0,0235858	0,0265393
2	121	0,0297296	0,0345605	0,0411111
3	121	0,0629767	0,0732101	0,0870863
4	127	0,0222612	0,0257909	0,0305417

Bartlett's Test (normal distribution)
Test statistic = 277,73; p-value = 0,000
Levene's Test (any continuous distribution)
Test statistic = 4,97; p-value = 0,002

In the table 6 bellow are shown the results of ANOVA test.

Table 6: One-way ANOVA: RET ASE+IL+P+A versus GROUP

Source	DF	SS	MS	F	P
GROUP	3	0,00331	0,00110	0,67	**0,570**
Error	614	1,00827	0,00164		
Total	**617**	1,01157			

S = 0,04052 R-Sq = 0,33% R-Sq(adj) = 0,00%

				Individual 95% CIs For Mean Based on Pooled StDev
Level	**N**	**Mean**	**StDev**	--+---------+---------+---------+-------
1	249	0,00254	0,02359	(---------*---------)
2	121	0,00012	0,03456	(-------------*-------------)
3	121	-0,00369	0,07321	(-------------*-------------)
4	127	0,00157	0,02579	(-------------*-------------)
				--+---------+---------+---------+-------
				-0,0100 -0,0050 0,0000 0,0050

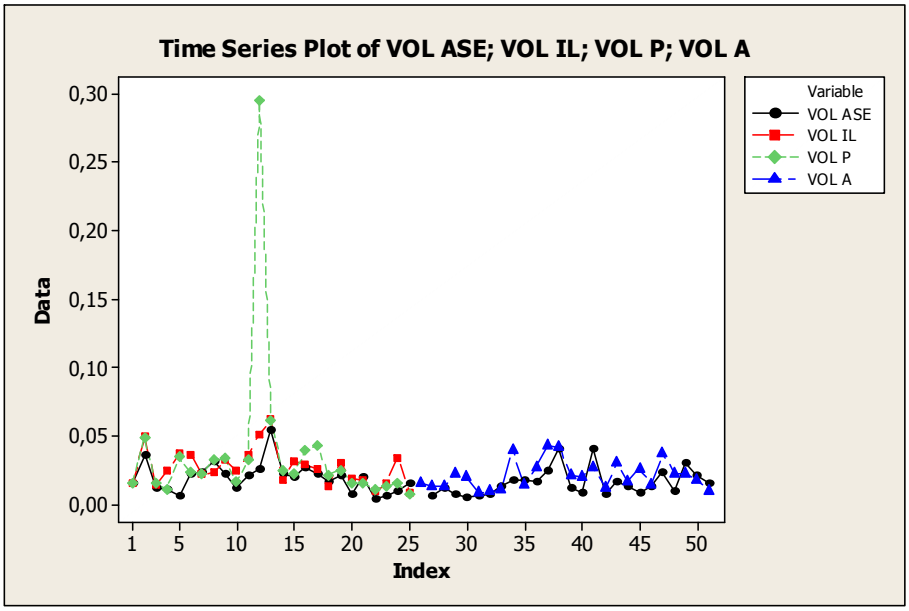
Pooled StDev = 0,04052

The p-value of the test does not reject the hypothesis of means equality. However, the difference in group variances, after the Bartlett's and Levene's tests weakens the validity of this conclusion.

4.5. Volatilities and ANOVA Test for Means Equality of VOL ASE, VOL IL, VOL P and VOL A

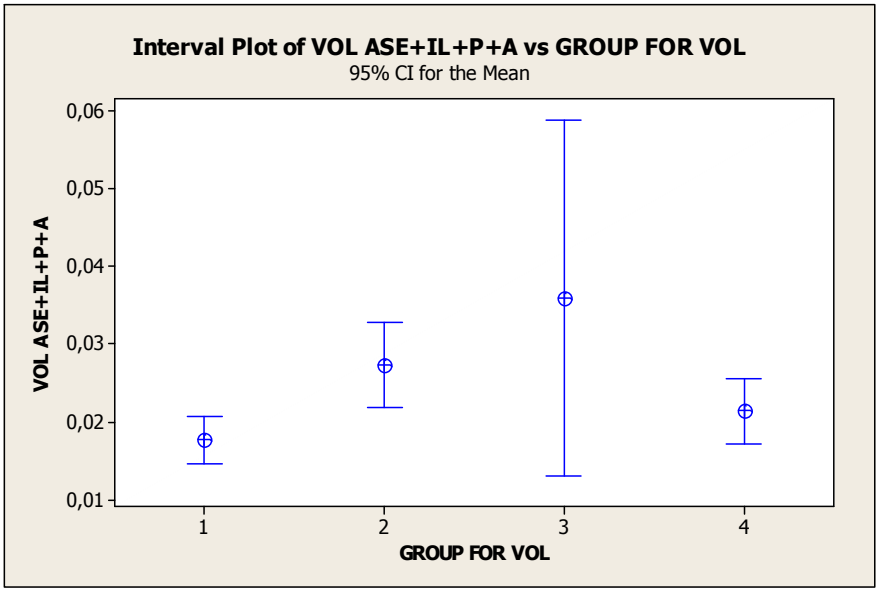
In the graph 5 below are shown the courses of the weekly volatilities of the ASE. In the graph is clearly detected the effect of the aberrant return of the stock P on 31-03-1999.

Graph 5:



In the graph 6 below are shown the interval plots of the volatilities:

Graph 6:



Descriptive Statistics: VOL ASE; VOL IL; VOL P; VOL A

Variable	Mean	StDev	Minimum	Maximum
VOL ASE	0,01762	0,01045	0,00420	0,05480
VOL IL	0,02720	0,01333	0,00900	0,06250
VOL P	0,0358	0,0554	0,00750	0,2946
VOL A	0,02132	0,01027	0,00800	0,04290

The (generalized) annual volatility of all series is shown in table 7 (excerpt from the excel file).

Table 7: Generalized annual volatility

	VOLATILITY ASE	VOLATILITY IL	VOLATILITY P	VOLATILITY A
AvWeekVol =	0,0176	0,0272	0,0358	0,0213
GenerAnnualVol %=	12,7005	19,6048	25,8160	15,3684

The graph 6 exposes differences between the annual volatilities. In order to check significance of these differences we apply once more the ANOVA technique. The analysis results are shown in the table 8 below

Table 8: One-way ANOVA: VOL ASE; VOL IL; VOL P; VOL A

Source	DF	SS	MS	F	P
Factor	3	0,005960	0,001987	2,82	0,042
Error	122	0,086033	0,000705		
Total	**125**	**0,091993**			

S = 0,02656 R-Sq = 6,48% R-Sq(adj) = 4,18%

				Individual 95% CIs For Mean Based on Pooled StDev			
Level	**N**	**Mean**	**StDev**	+---------+---------+---------+---------			
VOL ASE	50	0,01762	0,01045	(-------*------)			
VOL IL	25	0,02720	0,01333	(---------*---------)			
VOL P	25	0,03580	0,05545	(---------*---------)			
VOL A	26	0,02132	0,01027	(---------*---------)			
				+------------+------+------------+------------			
				0,010	0,020	0,030	0,040

Pooled StDev = 0,02656

The p-value of the test is 0,042-just in the border of rejection or non rejection of the equal means of volatilities- so the test is rather undecisable. Besides, the Bartlett's test rejects the equal variances hypothesis (p-value=0,000), while the Levene's does not (graph 7 and table 9). This is a supporting argument for undecisability in the hypothesis of equal means in the volatilities.

Graph 7:

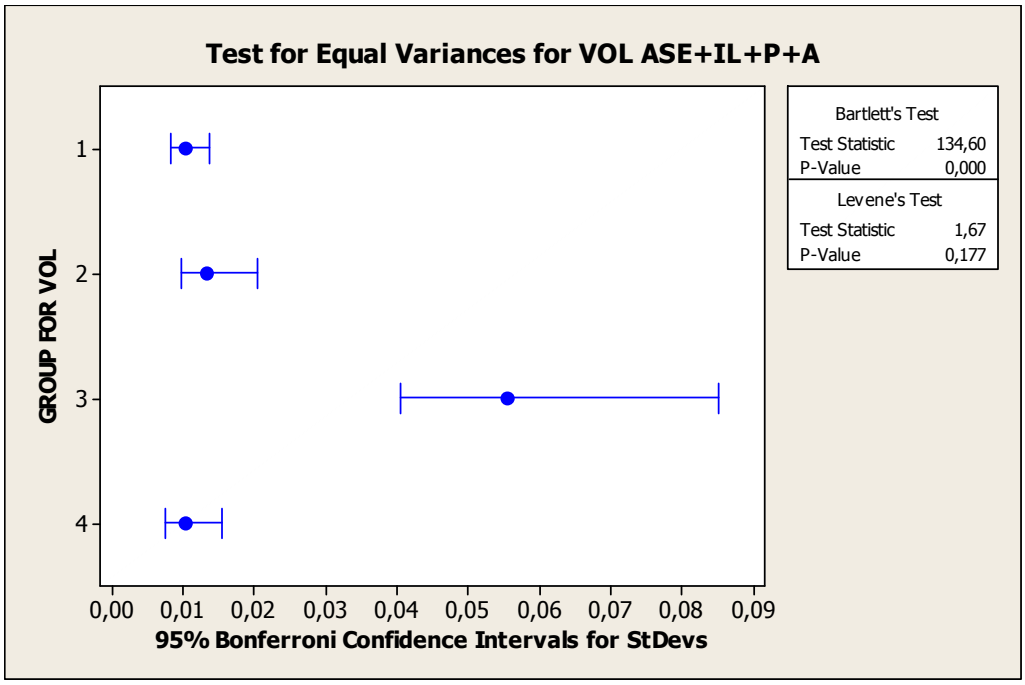


Table 9: Test for Equal Variances: VOL ASE+IL+P+A versus GROUP FOR VOL

95% Bonferroni confidence intervals for standard deviations

GROUP FOR VOL	N	Lower	StDev	Upper
1	50	0,0083282	0,0104525	0,0138841
2	25	0,0097604	0,0133264	0,0204587
3	25	0,0406085	0,0554451	0,0851196
4	26	0,0075634	0,0102706	0,0156066

Bartlett's Test (normal distribution)
Test statistic = 134,60; **p-value = 0,000**
Levene's Test (any continuous distribution)
Test statistic = 1,67; **p-value = 0,177**

5. Concluding Remarks

All the statistics employed to compare the situation before the merger of IONIKI-LAIKI bank with PISTEOS bank in order to create the new one, the ALPHA bank to the situation after the merger clearly advocate for the conclusion that the merger was to the benefit of both banks:

a) The resulted bank recorded higher returns than these of its components (RET IL=0,000124 ; RET P= -0,00369 ; RET A=0,00157).
b) The correlation and the regression analysis showed that the new bank follows closer the overall index than the parent banks, which means less non systematic risk.
c) the volatility in the stock of the new bank was found to be less than the volatilities of the single stocks (15,36% for ALPHA against 19,60% for IONIKI-LAIKI and 25,81% for PISTEOS).
d) The statistical significance of the above estimates was tested with the ANOVA technique and the differences of the measurments before and after were found to be significant under the reservation that the violation of the variances between the groups did not substantially affected the results of ANOVA.

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