DETERMINANTS OF CAPITAL ADEQUACY RATIO IN SELECTED BOSNIAN BANKS

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Abstract

The analysis of a data set of observation for 10 banks in period of 6 years in B&H shows how Capital Adequacy Ratio (CAR) is influenced by many factors such as: capital structure, size of the bank, profitability indicators, participation of deposits and loans in total asset, and leverage. Selected variables are chosen on the previous research and analysis is done through several methods and some diagnostics tests are performed in order to determine the most appropriate model that explains determinants of CAR. Results indicate based on data that SIZE, DEP, LOA, ROA, ROE AND LEV have significant effect on CAR. On the other hand LLR and NIM do not appear to have significant effect on CAR. Variables SIZE, DEP, LOA and ROA have negative effect on CAR, while variables LLR, ROE, NIM and LEV are positively related with CAR. All variables except LOA and ROA have expected signs. It is hard to distinguish which CAR is better higher or lower, form stability aspect it is better to have higher CAR, but from profitability side lower CAR is more preferable, so the banks should decide based on this study which variable to use in order to reach targeted CAR level.

Key Words: Capital Adequacy Ratio (CAR), Banks, Profitability, Panel Data, Econometric Modeling

JEL Classification: C01,C02,C12,C23,C58

1. Introduction

The purpose of this study is to investigate the determinants of capital adequacy ratio in selected Bosnian banks. Through this work it is analyzed how capital adequacy ratio (CAR) is influenced by capital structure, size of the bank, profitability indicators, participation of deposits and loans in total asset, and leverage. Analysis covers 10 banks and data for period 2005 to 2010. Nature of data is specific because of data available.

2. Methodology

The aim of this research is to identify factors influencing CAR in 10 selected banks in Bosnia and Herzegovina. Sample consists of 10 banks, mostly because of the availability of data. This study uses the secondary data and data obtained from annual reports of the banks, reports from Banking Agency of Federation of Bosnia and Herzegovina (FBA). In this analysis the panel data methodology is supposed to be used, but after the tests performed, the methodology that is the best appropriate for this analysis is pooled OLS. It analyzed the relationship between bank size (amount of total assets), deposits and loans share in total assets, loan loss reserves, profitability ratios, leverage as independent variables and CAR which represents dependent variable.

The selection of those variables is based on their influence on CAR, theoreticaly and empirically proven.

Model hypothesized is as follows:

$$CAR = f(SIZE, DEP, LOA, LLR, ROA, ROE, NIM, LEV)$$

Where:

CAR - dependent variable, capital adequacy ratio, ratio of capital to Risk-weighted assets

SIZE- natural logarithm of the total assets, assets are expressed in thousands of KM

DEP - ratio of deposits to total assets,

LOA – ratio of loans to total assets

LLR – loan loss reserves, ratio of loan loss provision to total loans

ROA – return on assets, ration of net income to assets

ROE – return on equity, ratio of net income to equity

NIM – ratio of net interest income to total assets

LEV – leverage, ratio of equity to total liabilities

This represents the initial model that will be tested through research. The dependent variable is **CAR** and independent variables are ***SIZE, DEP, LOA, LLR, ROA, ROE, NIM,*** and ***LEV.***

Econometric model is

$$CAR = \beta_0 + \beta_1 SIZE + \beta_2 DEP + \beta_3 LOA + \beta_4 LLR + \beta_5 ROA + \beta_6 ROE + \beta_7 NIM + \beta_8 LEV + u_i$$

Where β_0 is constant and β is coefficient of variables while u_i is the residual error of regression.

The model will be estimated in linear -log form, based on the assumption that dependent and independent variable are not linearly related. For 1% change in independent variable there is 0.01 $\boldsymbol{\beta_1}$ change in the dependent variable, in CAR.

Ho: **Hypothesis for each variable is that the selected variable has no significant impact on banks` capital adequacy ratio.**

Bank Size is important factor influencing the capital and it is related with ownership characteristics and access to the equity capital. Some research as it is mention in Büyüksalvarcı and Abdioğlu (2011) say that some banks want to keep good ratings so it has higher reserves and larger size, while in some larger banks the relationship between capital adequacy ratio and size is negative. It can be used in order to reduce risk exposure by asset`s diversification.

Increase in **deposits** should be followed by the increase in capital requirements so that rights of the depositors are protected as well as to protect bank from insolvency. In the case if the depositors are not able to determine the position of the bank, financial soundness, the CAR will be lower than optimal. As stated in Büyüksalvarcı and Abdioğlu (2011), Asarkaya and Ozcan(2007) found the negative relationship between share of deposits and capital adequacy ratio.

Loan measures the impact of loans in assets portfolio. Increase in risk leads to higher capital ratio in order to compensate depositors for risk taking.

Negative relation of **Loan loss reserves** means that in period of difficulties bank has slower adjusted capital ratio. Positive relationship can be seen as the bank voluntary increase car in order to overcome bad financial situation. Blose (2001), Hassan (1992) and Chol (2000) found negative relationship between capital adequacy ratio and loan loss reserves.

ROA and ROE, bank in order to have higher return increase its risk assets.

Net Interest Margin sign depends on the default risk.

High **leveraged** banks hold more equity so there is positive relationship.

The expected relationship between the bank specific variables and the bank capital adequacy ratio is indicated in the Table 1.

Table 1: Predicted Signs of Variables Coefficient

Variables	Predicted Signs
Size	+/-
Deposits	+/-
Loans	+
Loan Loss Reserves	+/-
ROA	+
ROE	+
NIM	+ / -
LEV	+

Source: Author`s Calculation

3. Results

Various descriptive statistics are calculated of the variables under study in order to describe the basic characteristics of these variables. Table 2 shows the descriptive statistics of the data containing sample means, standard deviations, minimum and maximum value.

Table 2: Descriptive Statistics of Varables

Variable	Obs	Mean	Std. Dev.	Min	Max
Car	60	.2774783	.1772545	.12	.71
Size	60	6.124009	1.168108	4.613863	8.365334
Dep	60	.6830617	.0992661	.4451	.8221
Loa	60	.5642933	.1128429	.3264	.7712
Llr	60	.0459967	.0183662	.0231	.1071
Roa	60	.0041567	.0114042	-.047	.0379
Roe	60	.0297233	.0912045	-.4512	.1679
Nim	60	.0405667	.0161792	.0129	.09
Lev	60	.260555	.249596	.0691	1.1226

Source: Author`s Calculation

The dependent and independent variables are tested for multicollinearity based on a simple correlation and covariance matrix. As depicted in Table 3 and Table 4, all of them have no collinearity problem.

Table 3: Correlation Matrix

Corr	car	size	dep	loa	llr	roa	roe	nim	lev
Car	1.000								
Size	-0.7074	1.000							
Dep	-0.5833	0.3072	1.000						
Loa	-0.5814	0.4238	-0.0499	1.00					
Llr	0.1299	-0.1763	0.2352	-0.4991	1.000				
Roa	0.2011	0.0368	-0.1612	-0.0476	-0.1831	1.000			
Roe	-0.1325	0.3086	0.1523	-0.0558	-0.0839	0.8259	1.000		
Nim	0.1132	-0.2424	-0.3969	0.4821	-0.3495	0.1304	-0.1341	1.000	
Lev	0.9277	-0.6326	-0.6468	-0.3944	-0.0451	0.3596	-0.0726	0.2394	1.000

Source: Author`s Calculation

Table 4: Covariance Matrix

Cov	car	size	dep	loa	llr	roa	roe	nim	lev
Car	.031419								
Size	-.146468	136.448							
Dep	-.010264	.035625	.009854						
Loa	-.011628	.055865	-.000559	.012734					
Llr	.000423	-.003782	.000429	-.001034	.000337				
Roa	.000406	.000491	-.000183	-.000061	-.000038	.00013			
Roe	-.002142	.032873	.001379	-.000574	-.000141	.000859	.008318		
Nim	.000325	-.004582	-.000637	.00088	-.000104	.000024	-.000198	.000262	
Lev	.041044	-.184424	-.016024	-.011108	-.000207	.001024	-.001652	.000967	.062298

Source: Author`s Calculation

The dependent variable is CAR, Capital Adequacy Ratio. Model I, Model II and Model III correspond to OLS, Random and Fixed effect Model. (Table5)

Table 5: Models tested, OLS, Fixed effect, Random Effect Model

Model	OLS		Random		Fixed	
Car	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Size	-.0152029	.00785	-.0135006	.0097294	.0280124	.0241562
Dep	-.1903701	.0884331	-.1831082	.0940473	-.1476711	.1172047
Loa	-.3453338	.0957583	-.3388201	.1013298	-.3937324	.1216016
Llr	.4092208	.3899371	.4734445	.4288399	.7992829	.5530649
Roa	-4.338.095	1.593.171	-4.159429	1.636084	-2.664067	1.908582
Roe	.3896034	.1852894	.3827237	.1879178	.381162	.2068153
Nim	.3848122	.5333897	.2646879	.6446825	-1.354814	1.235462
Lev	.5802835	.0599912	.5861709	.0665238	.6007078	.1240916
_cons	.5163077	.1191139	.4970934	.127146	.2904017	.1796895
R-squared	= 0.9457		R-sq: within = 0.6646		R-sq: within = 0.7020	
Adj R-squared	= 0.9372		between = 0.9954		between = 0.8327	
			overall = 0.9454		overall = 0.8128	
No.observation	60		60		60	

Source: Author`s Calculation

The estimated regression line is

$$CAR = 0.5163077 - 0.152029\ SIZE - 0.190701\ DEP - 0.3453338\ LOA + 0.4092208\ LLR - 4.4338095\ ROA + 0.3896034\ ROE + 0.3848122\ NIM + 0.5802835\ LEV + u_i$$

The robust standard error (SE) of β_0 is 0.1646703, of β_1 is 0.0072198, of β_2 is 0.0765815, of β_3 is 0.1208081, of β_4 is 0.5704211, of β_5 is 1.742144 , of β_6 is 0.181226, of β_7 is 0.3903047, of β_8 is 0.0782434.

The R-square of regression is 0.9457, while adjusted R- square is 0.9372. Adjusted R-square is used as better measure of fit, and it means that model can explain 94.57% or 93.72% of variability in dependent variable, Capital Adequacy Ratio can be explained by the independent variables, SIZE, DEPOSITS, LOANS, ROA, ROE, LLR, NIM and LEVERAGE.

The standard error of regression is 0.04442.

The initial methodology was panel data, and the regression for fixed and random effects was performed. In order to select which model is better fixed or random effect model, Hausman test is run. The Hausman test based on Chi- squared statistic (6.09, df.8 with prob. 0.6369) suggested that corresponding effects are statistically insignificant, so the null hypothesis is accepted and random effect model is preferred. (Appendix) LM test is performed that helps to decide between a random effects regression and a simple OLS regression. There is no significant difference across units and the results were in favor of OLS (Chi-squared = 2.81 with prob. 0.0939).

The final model that best explains the determinants of the CAR is OLS regression model. The model was tested for OLS assumptions, and the results of tests (Appendix) show that it does not suffer from omitted variable bias. The null hypothesis is that the model does not have omitted-variables bias, the p-value is higher than the usual threshold of 0.05 (95% significance), so we fail to reject the null and conclude that we do not need more variables. The model was tested for Heteroskedasticity and there was problem of Heteroskedasticity(p=0.003) and it is solved by using robust standard errors.

$$CAR = 0.5163077 - 0.0152029\ SIZE - 0.190701\ DEP - 0.3453338\ LOA + 0.4092208\ LLR -$$
$$(0.1646703)\quad (0.0072198)\quad (0.0765815)\quad (0.1208081)\quad (0.5704211)$$

$$4.4338095\ ROA + 0.3896034\ ROE + 0.3848122\ NIM + 0.5802835\ LEV + u_i$$
$$(1.742144)\quad (0.181226)\quad (0.3903047)\quad (0.0782434)$$

Table 6: Summary of Hypothesis Testing

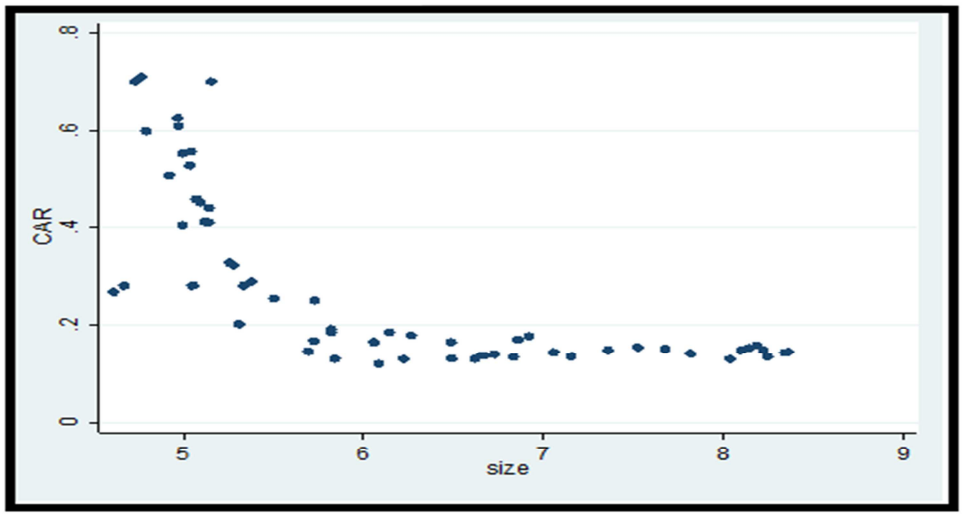
Variable	Sign	Reject H0	Sigf.level
SIZE	-	Yes	0.1
DEP	-	Yes	0.05
LOA	-	Yes	0.001
LLR	+	No	-
ROA	-	Yes	0.01
ROE	+	Yes	0.05
NIM	+	No	-
LEV	+	Yes	0.001

Source: Author`s Calculation

It is shown that variables (Table 6): LOAN, DEPOSIT, SIZE, ROA, ROE, LEVERAGE have statistically significant influence on CAR , LLR and NIM have no statistically significant effect, but according to the rule of thumb if t- statistics >1, those variables are kept in the model.

All variables, except ROA and LOA have expected signs. Increase in SIZE by 1% leads to 0.000152 unit decrease in CAR and scatter plot downward slopes. The rationality lies in fact that a larger size can guarantee greater stability and lower CAR is needed. It is based on assumption "too-big to fail". The general opinion is that asset size is inversely related to capital adequacy. The coefficient on ROA shows that a one unit of increase in ROA decreases CAR by 4.338095 units, while unit increase in ROE increases CAR by 0.3896034. Bank with higher capital can have higher profitability, which can lead to negative sign on ROA because of negative relation with assets and CAR. Also bank with higher ROE can afford to use larger CAR. Unit increase in DEP and LOA lead to decrease in CAR by 0.1903701 and 0.3453338 units respectively. A high deposit means that the bank has more stable reserves and capital may relatively decrease. Negative sign of LOA can be explained in way that banks in order to provide more loans transform more capital into loans and assets increase and CAR decreases. Increase by LLR, NIM and LEV leads to increase in CAR by 0.4092208, 0.3848122 and 0.5802835 units respectively.LLR represents the credit risk, so credit risk level is positively correlated with the bankruptcy probability and LLR effect on CAR is positive. High amount of Loan Loss reserves is commonly signifying a high risk because the bank expects loans will default. The worse is the financial health of bank, the capital adequacy is higher. High leveraged banks hold more equity so there is positive relationship. Higher profitability imposes better opportunities for rising new capital so NIM effect on CAR is positive.

Figure 1: Scatter plot car and size



4. Conclusion

The analysis of a data set of observation for 10 banks in period of 6 years in B&H presented in this report shows how CAR is influenced by many factors. Selected variables are chosen on the previous research and analysis is done through several methods and some diagnostics tests are performed in order to determine the most appropriate model that explains the determinants of capital adequacy ratio. After performing analysis and developing econometric model results indicate that according to these data that SIZE, DEP, LOA, ROA, ROE AND LEV have significant effect on CAR. On the other hand LLR and NIM do not appear to have significant effect on CAR. Variables SIZE, DEP, LOA and ROA have negative effect on CAR, while variables LLR, ROE, NIM and LEV are positively related with CAR. All variables except LOA and ROA have expected signs. It is hard to distinguish which CAR is better higher or lower, form stability aspect it is better to have higher CAR, but from profitability side lower CAR is more preferable, so the banks should decide based on this study which variable to use in order to reach targeted CAR level.

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APPENDIX

STATA 11 –Output

Appendix 1 : Panel Data

```
. xtset bank year
       panel variable:  bank (strongly balanced)
        time variable:  year, 2005 to 2010
                delta:  1 unit
```

Appendix 2: Descriptive Statistics

```
. summarize car size dep loa llr roa roe nim lev
```

Variable	Obs	Mean	Std. Dev.	Min	Max
car	60	.2774783	.1772545	.12	.71
size	60	6.124009	1.168108	4.613863	8.365334
dep	60	.6830617	.0992661	.4451	.8221
loa	60	.5642933	.1128429	.3264	.7712
llr	60	.0459967	.0183662	.0231	.1071
roa	60	.0041567	.0114042	-.047	.0379
roe	60	.0297233	.0912045	-.4512	.1679
nim	60	.0405667	.0161792	.0129	.09
lev	60	.260555	.249596	.0691	1.1226

Appendix 3: Correlation Matrix

```
. correlate car size dep loa llr roa roe nim lev
(obs=60)
```

	car	size	dep	loa	llr	roa	roe	nim	lev
car	1.0000								
size	-0.7074	1.0000							
dep	-0.5833	0.3072	1.0000						
loa	-0.5814	0.4238	-0.0499	1.0000					
llr	0.1299	-0.1763	0.2352	-0.4991	1.0000				
roa	0.2011	0.0368	-0.1612	-0.0476	-0.1831	1.0000			
roe	-0.1325	0.3086	0.1523	-0.0558	-0.0839	0.8259	1.0000		
nim	0.1132	-0.2424	-0.3969	0.4821	-0.3495	0.1304	-0.1341	1.0000	
lev	0.9277	-0.6326	-0.6468	-0.3944	-0.0451	0.3596	-0.0726	0.2394	1.0000

Appendix 4: Covariance matrix

```
. correlate car size dep loa llr roa roe nim lev, covariance
(obs=60)
```

	car	size	dep	loa	llr	roa	roe	nim	lev
car	.031419								
size	-.146468	1.36448							
dep	-.010264	.035625	.009854						
loa	-.011628	.055865	-.000559	.012734					
llr	.000423	-.003782	.000429	-.001034	.000337				
roa	.000406	.000491	-.000183	-.000061	-.000038	.00013			
roe	-.002142	.032873	.001379	-.000574	-.000141	.000859	.008318		
nim	.000325	-.004582	-.000637	.00088	-.000104	.000024	-.000198	.000262	
lev	.041044	-.184424	-.016024	-.011108	-.000207	.001024	-.001652	.000967	.062298

Appendix 5 : Pooled OLS Regression

```
. regress car size dep loa llr roa roe nim lev
```

Source	SS	df	MS
Model	1.75310416	8	.21913802
Residual	.100626892	51	.001973076
Total	1.85373105	59	.03141917

```
Number of obs =      60
F(  8,    51) =  111.06
Prob > F      =  0.0000
R-squared     =  0.9457
Adj R-squared =  0.9372
Root MSE      =  .04442
```

car	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
size	-.0152029	.00785	-1.94	0.058	-.0309625	.0005567
dep	-.1903701	.0884331	-2.15	0.036	-.3679068	-.0128333
loa	-.3453338	.0957583	-3.61	0.001	-.5375767	-.1530909
llr	.4092208	.3899371	1.05	0.299	-.3736106	1.192052
roa	-4.338095	1.593171	-2.72	0.009	-7.53652	-1.139671
roe	.3896034	.1852894	2.10	0.040	.0176195	.7615874
nim	.3848122	.5333897	0.72	0.474	-.6860123	1.455637
lev	.5802835	.0599912	9.67	0.000	.4598462	.7007209
_cons	.5163077	.1191139	4.33	0.000	.2771765	.7554388

Appendix 6: Random Effect Model

```
. xtreg car size dep loa llr roa roe nim lev,re

Random-effects GLS regression                   Number of obs      =        60
Group variable: bank                            Number of groups   =        10

R-sq:  within  = 0.6646                         Obs per group: min =         6
       between = 0.9954                                        avg =       6.0
       overall = 0.9454                                        max =         6

Random effects u_i ~ Gaussian                   Wald chi2(8)       =    510.50
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000
```

car	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
size	-.0135006	.0097294	-1.39	0.165	-.0325698	.0055686
dep	-.1831082	.0940473	-1.95	0.052	-.3674374	.001221
loa	-.3388201	.1013298	-3.34	0.001	-.5374229	-.1402173
llr	.4734445	.4288399	1.10	0.270	-.3670663	1.313955
roa	-4.159429	1.636084	-2.54	0.011	-7.366095	-.9527625
roe	.3827237	.1879178	2.04	0.042	.0144115	.7510359
nim	.2646879	.6446825	0.41	0.681	-.9988666	1.528242
lev	.5861709	.0665238	8.81	0.000	.4557867	.7165552
_cons	.4970934	.127146	3.91	0.000	.2478918	.7462949
sigma_u	.01800301					
sigma_e	.04456688					
rho	.14028753	(fraction of variance due to u_i)				

Appendix 7: Fixed Effect Model

```
. xtreg car size dep loa llr roa roe nim lev,fe

Fixed-effects (within) regression               Number of obs      =        60
Group variable: bank                            Number of groups   =        10

R-sq:  within  = 0.7020                         Obs per group: min =         6
       between = 0.8327                                        avg =       6.0
       overall = 0.8128                                        max =         6

                                                F(8,42)            =     12.37
corr(u_i, Xb)  = 0.0833                         Prob > F           =    0.0000
```

car	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
size	.0280124	.0241562	1.16	0.253	-.0207368	.0767616
dep	-.1476711	.1172047	-1.26	0.215	-.3841998	.0888576
loa	-.3937324	.1216016	-3.24	0.002	-.6391344	-.1483303
llr	.7992829	.5530649	1.45	0.156	-.3168471	1.915413
roa	-2.664067	1.908582	-1.40	0.170	-6.515742	1.187608
roe	.381162	.2068153	1.84	0.072	-.0362082	.7985322
nim	-1.354814	1.235462	-1.10	0.279	-3.848077	1.138448
lev	.6007078	.1240916	4.84	0.000	.3502807	.8511349
_cons	.2904017	.1796895	1.62	0.114	-.0722264	.6530298
sigma_u	.07010278					
sigma_e	.04456688					
rho	.71216927	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(9, 42) =     0.96                 Prob > F = 0.4838
```

Appendix 8: Comparison of the OLS, Fixed and Random Model

```
. estimates table fixed ols random, star stats(N r2 r2_a)
```

Variable	fixed	ols	random
size	.02801244	-.0152029	-.01350055
dep	-.14767112	-.19037005*	-.1831082
loa	-.39373238**	-.34533382***	-.3388201***
llr	.79928295	.40922082	.47344454
roa	-2.6640668	-4.3380954**	-4.1594285*
roe	.38116205	.38960344*	.38272368*
nim	-1.3548144	.38481224	.26468793
lev	.60070781***	.58028351***	.58617093***
_cons	.29040169	.51630766***	.49709335***
N	60	60	60
r2	.70200728	.94571656	
r2_a	.58139118	.93720151	

legend: * p<0.05; ** p<0.01; *** p<0.001

Appendix 9: Hausman Test

```
. hausman fixed random
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
size	.0280124	-.0135006	.041513	.0221102
dep	-.1476711	-.1831082	.0354371	.0699433
loa	-.3937324	-.3388201	-.0549123	.0672252
llr	.7992829	.4734445	.3258384	.3492521
roa	-2.664067	-4.159429	1.495362	.9828099
roe	.381162	.3827237	-.0015616	.0863682
nim	-1.354814	.2646879	-1.619502	1.053921
lev	.6007078	.5861709	.0145369	.1047536

```
                b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =         6.09
            Prob>chi2 =       0.6369
```

Appendix 10: Test for Heteroskedasticity- Fixed Model

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (10)  =     492.04
Prob>chi2 =      0.0000
```

Appendix 11: LM Test for choice between Random or Pooled OLS Model

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        car[bank,t] = Xb + u[bank] + e[bank,t]

        Estimated results:
```

	Var	sd = sqrt(Var)
car	.0314192	.1772545
e	.0019862	.0445669
u	.0003241	.018003

```
        Test:   Var(u) = 0
                            chi2(1) =     2.81
                        Prob > chi2 =     0.0939
```

Appendix 12: Test for Heteroskedasticity OLS

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of car

         chi2(1)      =    13.18
         Prob > chi2  =   0.0003
```

Appendix 13: Random effect Model, Robust Error

```
. xtreg car size dep loa llr roa roe nim lev,re robust

Random-effects GLS regression                   Number of obs      =        60
Group variable: bank                            Number of groups   =        10

R-sq:  within  = 0.6646                         Obs per group: min =         6
       between = 0.9954                                        avg =       6.0
       overall = 0.9454                                        max =         6

Random effects u_i ~ Gaussian                   Wald chi2(8)       =  12610.41
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

                                    (Std. Err. adjusted for 10 clusters in bank)
------------------------------------------------------------------------------
             |               Robust
         car |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        size |  -.0135006   .0067794    -1.99   0.046     -.026788   -.0002131
         dep |  -.1831082   .0834765    -2.19   0.028    -.3467191   -.0194973
         loa |  -.3388201   .1778656    -1.90   0.057    -.6874302      .00979
         llr |   .4734445    .604259     0.78   0.433    -.7108813     1.65777
         roa |  -4.159429   1.321114    -3.15   0.002    -6.748765   -1.570092
         roe |   .3827237    .154079     2.48   0.013     .0807343    .684713
         nim |   .2646879   .4675223     0.57   0.571    -.6516389    1.181015
         lev |   .5861709   .0792003     7.40   0.000     .4309412    .7414007
       _cons |   .4970934   .1570229     3.17   0.002     .1893341    .8048526
-------------+----------------------------------------------------------------
     sigma_u |   .01800301
     sigma_e |   .04456688
         rho |   .14028753   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Appendix 14: Fixed effect Model, Robust Error

```
. xtreg car size dep loa llr roa roe nim lev,fe robust

Fixed-effects (within) regression               Number of obs      =        60
Group variable: bank                            Number of groups   =        10

R-sq:  within  = 0.7020                         Obs per group: min =         6
       between = 0.8327                                        avg =       6.0
       overall = 0.8128                                        max =         6

                                                F(8,9)             =     49.83
corr(u_i, Xb)  = 0.0833                         Prob > F           =    0.0000

                                    (Std. Err. adjusted for 10 clusters in bank)
------------------------------------------------------------------------------
             |               Robust
         car |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        size |   .0280124   .0358973     0.78   0.455    -.0531928    .1092177
         dep |  -.1476711   .1171255    -1.26   0.239    -.4126275    .1172853
         loa |  -.3937324   .2205933    -1.78   0.108    -.8927491    .1052843
         llr |   .7992829   .7173754     1.11   0.294    -.8235329    2.422099
         roa |  -2.664067   1.955355    -1.36   0.206    -7.087387    1.759253
         roe |    .381162   .1663736     2.29   0.048     .0047989    .7575252
         nim |  -1.354814   1.887755    -0.72   0.491    -5.625213    2.915584
         lev |   .6007078    .126772     4.74   0.001     .3139297     .887486
       _cons |   .2904017   .1424667     2.04   0.072    -.0318803    .6126837
-------------+----------------------------------------------------------------
     sigma_u |   .07010278
     sigma_e |   .04456688
         rho |   .71216927   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Appendix 15: Pooled OLS Model, Robust Error

```
. regress car size dep loa llr roa roe nim lev, robust

Linear regression                               Number of obs =        60
                                                F(  8,    51) =    218.21
                                                Prob > F      =    0.0000
                                                R-squared     =    0.9457
                                                Root MSE      =    .04442

------------------------------------------------------------------------------
             |               Robust
         car |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        size |  -.0152029   .0072198    -2.11   0.040    -.0296973   -.0007085
         dep |  -.1903701   .0765815    -2.49   0.016    -.3441138   -.0366263
         loa |  -.3453338   .1208081    -2.86   0.006    -.5878661   -.1028015
         llr |   .4092208   .5704211     0.72   0.476    -.7359474    1.554389
         roa |  -4.338095   1.742144    -2.49   0.016    -7.835595   -.8405963
         roe |   .3896034    .181226     2.15   0.036      .025777    .7534299
         nim |   .3848122   .3903047     0.99   0.329    -.3987572    1.168382
         lev |   .5802835   .0782434     7.42   0.000     .4232034    .7373636
       _cons |   .5163077   .1646703     3.14   0.003     .1857183     .846897
------------------------------------------------------------------------------
```

Appendix 16: Ramsey Test for Omitted Variables

```
. ovtest

Ramsey RESET test using powers of the fitted values of car
       Ho:  model has no omitted variables
                  F(3, 48) =      2.01
                  Prob > F =      0.1245

.
```

Appendix 17: Scatter plot for CAR and Asset