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Profitability of Sudanese Commercial Bank (Panel Data Manipulation)

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Abstract: *In this study Sudanese commercial bank was examined through generalized regression models namely, fixed effect and random effect. The model incorporated two explanatory variables particularly assets and liabilities as main variables in explaining the profitability , more over three additional dummy variables were introduced as explanatory variables to count and control for unobserved individual effects. These dummies are size of started capital, equities ownership and maturity of the bank. The results were revealed that random effect estimator was suitable to and hence the unobserved individual effects were uncorrelated with the main explanatory variables of the study. Assets and liabilities affect bank profitability positively, in addition, the dummies foreign ownership of equities, bank maturity affect bank profitability positively , while lumpy size of capital contributes negatively to bank profitability.*

Keyword: *Bank Profitability, fixed effects, random effects.*

I. Introduction

Panel data needs special manipulation in order to obtain proper estimates. Here the traditional regression models were weak in estimating the parameters of data characterized by panel nature. Because of existing unobserved effects on the phenomena under study special technique must introduce to count for. In effect the appropriate technique is generalized regression estimators which deal perfectly with pooled data (fixed effect & random effect). The suggested models allow for efficient estimates by identifying the effects which are not be simply detectable in pure cross-section and pure time series data.

The unobserved effects are either correlated or uncorrelated with explanatory variables. Accordingly, such dynamic behavior of generalized suggested models can able to study the complex issue such as bank profitability via either fixed effect or random effect regression when the pooled tradition OLS fails to control the individual unobserved effects.

II. Panel Data

Data with cross-sectional and time series aspects can often shed light on important policy questions, there one an independently pooled cross section which obtains by sampling randomly from a large population at of different point in time casually , but not necessary, of differentyears or in every other years,from statistical stand point these data sets have an important feature, they consist of independently sample observations, which is a key aspect of analyzing cross- sectional data though it rules out correlation in the error them acrossdifferent observations .

A panel data set, while having both across- sectional and a time series dimensiondiffers in some important aspects from an independently pooled cross section. To collect panel data as longitudinal data thereis attempt to follow the same population across time.

For the econometric analysis of panel data observations are not assume to be indecently distributed across time because unobserved factors affect the phenomena under study, for this reason special models and methods developed to analyzepaneldata .

There exist straight forward method of differencing to remove time-constant unobserved attributes of the unit being studied, in addition describing the statistical properties of estimated precedents ore audible on intuition because panel data method one to somewhat advanced .

If a random sample is drown at each time period, pooling the resulting random sample gives us an independently pool cross section. one reason for using independently pool cross section is to increase the sample size . By pooling random sample drawn from the same population, but at different points in time, we can get more precise estimators and test statistics with more power. Pooling is helpful if the relationship between the dependent variable and at least some of independentvariablesremain constant over time.

Using cross section raises only minor statistical complications. If allowing the intercept to differ across periods in usually years, the fact that the population may have different distributionsin differentyears is being reflected. This is easily accomplished by including dummy variables for all but one year, where the earliest year in the sample is chosen as the base year, sometime, the pattern of coefficients on the year dummy variables is itself of interest.

To examine the structural change across time we use chow test to determine whether a multiple regression function differs acrosstwo or many groups, computing time period by interacting each variable with a year dummy for one of the two year and testing for joint significance of the year dummy and all of the interaction terms .

A chow rest can also be computed for more than two time periods. It is usually more interesting to allow the intercepts to change over time and then test whether the slope coefficients have change one time. To test the constancy of the slope coefficients this is done generally by interacting all of the time period dummies (Except of base group) with one, several, or all of the explanatory variables and test the joint significance of the interaction.

Simple regression equation suffers from omittedvariables problem to control it for more factors by multipleregression.

But many factors might be hard to control for. An alternative way to use panel data is to view the unobserved factors affecting the dependent variable as consisting of two types: those that one constant and those that very overtime.

It is worthy to note that the variable which captures all unobserved is called an unobserved effect or fixed effect or unobserved heterogeneity as well. The error term is often called time-varying error because it represents unobserved factor that change over time and affect the dependent variable.

It we difference the variables then the error terms will not correlate with the explanatory variables in all time period and the resulting estimator is called first differenced estimator and the strict exogeneity assumption is rules out the case where the explanatory variable lagged dependent variable,herewe allow the explanatory to be correlated with unobservable that are constant over time.

Differencing panel data over time in order to eliminate a time - constant unobserved effect is a valuable method for obtaining causal effects- nevertheless differencing is not free of difficulties .Even when we do sufficient time variation in the explanatory variable first differenced estimation can be subject to serious bias . Unfortunately having more time period generally does not reduce the inconsistency of the first differenced estimator when the regressors are not strictly exogenous. Another important draw back to the FD estimator is that it can be worse than pooled OLS If one or more explanatory variable is subject to measurement error. Differencing a poorly measured regressor reduces it variation relative to its correlation with differenced error caused by classical measurement error resulting in a potentially sizable bias(potential pitfalls).

III. Fixed Effects

It uses for estimating unobserved effect panel data model.It is alternative methodtoo first difference which work better under certain assumption. It uses a transformation to remove the un observed effect prior to estimation, so any time constant exploratory variable are removed along with fixed effect (a_i) in the model. The data after transformation is called time-demeaned data and fired effects transformation is called within transformation, in addition the unobserved effect (a_i) will disappeared after the transformation process, A pooled OLS estimator that is based on time- demeaned variables is called the fixed effect estimator or within estimator i.e. OLS uses the time variation in Y and X within each cross- sectional observation.If we think about the fixed effects factor (a) correlated with the overages of explanatory variables we use between estimators i.e. obtained as OLS estimator on the cross- sectional equations.

Under a strict exogeneity assumption on explanatory variables the fixed effect estimator is unbiased, the idiosyncratic error should be uncorrelated with each explanatory variable a cross all time periods . the fixed effect estimator allows for arbitrary correlation between the fixed effect and the explanatory variables in any time period just as with first differencing- Because of this, any explanatory variable that is constant over time for all observations gets swept away by the fixed effect transformation. A traditional view of the fixed effects model is to assume the unobserved effect factor (a) is a parameter to be estimated by putting dummy variable for each cross-sectional observation a long with explanatory variables, hence method is called dummy variable for each cross-sectional observation along with explanatory variableregression.one benefit of dummy variable regression is that it properly computes the degree of freedom directly.Since both first differencing and fixed effect are unbiased and constant the choice between them relys on the relative efficiency of each estimator which is determined by the serial correlation in the idiosyncratic errors .So when the errorsterms are serially correlated fixed effect is more efficient that first differencing, herewe test the time demeaned errors.

IV. Random Effects

In this model the assumption is that the unobserved effect factor has zero mean and usually allow for time dummy among the explanatory variables as well.In fixed effects or first differencing the goal is to eliminates the fixed effect variable (a) because it thought to be correlated with one or more of the explanatory variables while in random effects model the assumption is that unobserved effect variable (a) is uncorrelated with each explanatory variable. In fixed effects estimator the time average is subtracted from the corresponding

variables while the random effect transformation subtracts a fraction of that time average where the fraction depends on the variance of the (idiosyncratic) error and the variance of unobserved effect variable.Under the random effects assumptions, the estimator is consistent (not biased) and asymptotically normally distributed.The transformed error uses in random effects estimation weight the un observed effect by (λ) which is derived from error variance and unobservedeffect variable variance more over its value between zero and one .When estimated (λ) is close to zero the random effect estimates will be close to the pooled OLS estimates. This is the case when the un observed effect variable has small variance relation to idiosyncratic error (unimportant) ,and when estimated (λ) tend to one this makes random effect and fixed effect estimates very similar.

Because fixed effects allow arbitrary correlation between the unobserved effect variable and the explanatory variables while random effects does not ,fixed effect is widely thought to be a more convincing tool for estimating ceterisper bus effects. But if the key explanatory variable are constant over time, wecannot use fixed effect to estimate ifs effect on the dependant variable .So we can use random effects as many time as constant controls as possible are included among the explanatory variables, while in fixed effect it is not necessary to include such controls. If our interest is in a time – varying explanatory variables, in this case the use of random effect is better than fixed effects .

In applied researches both random effect and fixed effect are used and then formally researches test for statistically significant differences is the coefficients on the time varying explanatory variables .Such test like Hausman test. Under this test a failure to reject the null hypotheses means either that the random effect and fixed effect are sufficiently close so we can use either of them. A rejection using the Hausman test is takentomean that the key random effect assumption (unobservedeffect variable in uncorrected with explanatory variable) is false and then the fixed effect estimators are used. In some applications of panel data methods sample isnot treated as a random sample from a large population in this case usually fixed effect is used and finally fixed effect is almost a always much more convincing than random effects for policy analysis using a aggregate data.

Pooling data gives a richer source of variation which allows for more efficient estimation of parameterswith additional more informative data, one can get more reliable estimates and test more sophisticated behavioral model with less restrictive assumptions.Another advantage of panel data sets are their ability to controlling for individual heterogeneity. Not controlling for these unobserved individual specific effect leads to bias in resulting estimates.Panel data sets are also better able to identify and estimate effect that is simply not delectable in pure cross- section or pure time series data.In particular, panel data sets one better able to study complex issues of dynamic behavior.

V. Empirical Model

The study aims to investigate about the main factors which affect the probability of commercial bank in Sudan.Hence the assets and liabilities were chosen as best factors contribute to bank profitability. The former factor contributes positively while the later contributes negatively. Other variables were introduced in the study as dummy variables to count for the effectof bank ownership, bank capital size as well as a bank maturity in the profitability.

The sample size of the study varies to cover different scopes of dummy reliable. Eight commercial banks are incorporated in the study.As for as ownership is concern three bank in the sample were owned by domestic citizen while six bank wereowned by foreign individuals, as far as maturityfour banks were young while fine were matured.The maturity is based on the experience of the bank if exceed ten years hence it classified as mature while if the experience blow ten years it classified as young bank. As far as capital size five banks have small running capital while four banks employ heavy running operating capital.

The following tables exhibits the concerns of dummy variable.

Bank	Size capital	Ownership	Maturity
Financial Investment	Small	Foreign	Immature
Barrka	Large	Foreign	Mature
Gazira	Large	Foreign	Immature
Khartoum	Large	Domestic	Mature
Elshamal	Small	Domestic	Mature
Untied capital	Small	Foreign	Immature
Blue Nile east	Small	Foreign	Immature
Faisal	Large	foreign	Mature
Industrial devolvement	Large	Domestic	Immature

The sample size covers the period from 2008 to 2014 so the series contain seven years and the cross section contain nine identifier (bank) hence each variable in the study contains sixty three items.

Pooled Descriptive

	Profit	**Asset**	**Liabilities**	**Residual**
Skewness	1.57	2.15	2	
Kurtosis	4.4	7.01	8.5	
Jarque – Bera value	31.3	90.8	122	70.7714
Jarque – Bera (prob.)	0.000	0.000	0.000	0.0000

From the a bone table the disciple of the study are were normal as showed by the value of Skewness and kurtosis statistics, these statistics are consolidated by Jarque- Bera test in which significantly the null hypothesis is highly rejected which reveals the none normality of each variable.

Cross section Descriptive Statistics:

	Jarque Bera	Sig	Jarque Bera	Sig	Jarque Bera	Sig	Jarque Bera	Sig
A-P	0.57	0.75	A-M	0.58	0.74	A-K	0.61	0.73
B-P	1.25	0.35	13-M	0.86	0.64	B-K	1.33	0.51
C-P	1.26	0.53	C-M	0.62	0.73	C-K	0.77	0.67
D-P	0.77	0.67	D-M	0.59	0.74	D-K	0.90	0.63
E-P	2.16	0.33	e-m	0.57	0.75	E-K	0.81	0.91
F-P	0.95	0.62	f-14	0.61	0.73	F-K	0.78	0.67
G-P	0.63	0.72	G-M	0.75	0.68	G-K	0.67	0.77
H-P	0.78	0.67	H-14	0.61	0.73	H-K	0.59	0.74
R-P	0.58	0.74	R-M	6.58	0.74	R-K	0.30	0.85

Where:

Symbol	Variable
A	Financial Investment Bank
B	Barrka Bank
C	Gazira Bank
D	Khartoum Bank
E	Elshamal Bank
F	Untied capital Bank
G	Blue Nile Mashraqe Bank
H	Faisal Islamic Bank
R-P	Industrial devolvement Bank
P	Profitability
M	Assets
K	Liabilities

From the above table the cross section variable statistics reveal normality from each variable with respect to the identifier (commercial bank) such results were assured by the values of Jerque-Bera test in which the null hypothesis was accepted as shown by the value of probability (more than five percent)

The cross section statistics dictate the importance of pooling the data in order to randomize the variable the study and hence straight for mend regression of panel data can be applied.

Pooled least squares:

	Coefficient	Prob.
Constant	-6445625	0.8440
Asset	0.025802	0.000
Liability	0.082565	0.0801
Foreign	32511668	0.0000
Maturity	-12644473	0.1112
Lumpy	-24917505	0.000
R-squared	0.78	
Adjusted R^2	0.76	
F statistics	40.86375	0.0000
Akaike info criteria	37.776	
Durbin-Watson	0.498940	

From the table the long run profitability of Sudanese commercial bank is diminishing as shown by the negative sign of constant term but the value is statistically insignificant. The asset contributes positively to the profitability more over the coefficient is statistically significant.Liabilities also contribute positively to the profitability and statistically the coefficient is significant, this result can be rationalized by the best exploitationof the debitsby the commercial bank.

As for as dummy variables, foreign ownership has positive effectson bank profitability, and is statistically significant. While the maturity and lumpy size of capital contribute negatively to bank profitability, the coefficient of maturity is statistically insignificant while lumpy capital one is statistically significant.

R squared and adjusted R squared are comparatively high in addition to significantF statistic which reveal best model ,but Durbin- Watson statistic to less than 0.5 which assured the existence of positive correlation in the model hence reduce the efficiency of the model.

Cross- section Random Effect Model:

Variable	coefficient	sig	Bank	Constant
Constant	-658663207	0.0818	Capital Investment	-37357848
ASSETs	0.006194	0.2603	BARAKA	-669858.4
LIABIALITIES	0.35394.7	0.000	GAZRIA	2969512
FOREIGN OWNERSHIP	77158290	0.0132	KHATROUM	-26129536
MATURITY	10940675	0.07191	SHEMAL	33228447
LUMPY CAPITAL	-37179058	0.1923	UNITED CAPITAL	-47777808
R-SQUARED	0.82		BULE NILE MESHRAQE	51907208
ADJUSTED R- SQUARED	0.81		FIASEL	30928794
F- STATISTICS	54.76	0.000	INDUSTERIAL-DEVELOPMENT	-7098912
DIRBIN- WATSON	1.053			
HAUSMANL TEST	Value 1.484180	P (0.4761)		

From the table the overall long run profitability of commercial bank is diminishing as assured by negative sign of constant term. The asset and liabilities, contribute positively to the profitability, worthily, liabilities coefficient is statistically significant while asset one is statistically insignificant.Foreign ownershipaswellas maturity of bank contribute positively to profitability while lumpy size of capital worse the profitability of the commercial bank. The coefficient of foreign ownership is statistically significant while those of maturity and lump capital are statistical insignificant.

As for as cross section constant the investment and capital , Al Barka, AL Khartoum, United capital and industrial development Bank are contributed negatively to commercial bank profitability as assured by negative signs of the coefficients , while Sudanese Jordanian Jazeera, El Shamal, Elmashrage Blue Nile and Fiasal bank contribute positively to commercial bank profitability.

R squared end adjusted R squared are comparatively high beyond 80%. F statistic is highly significant .Durbin- Watson is relatively better than ordinary pooled regression.

Hausman test accepted the null hypothesis which statesof suitability ofRandom effects regression to the model.

VI. Results

1. The distribution of each variable of the study separated by different bank is normal as shown by Jarque-Bera test of normality while the distribution of the variables when they pooled to all bank are none-normal as assured of Jarque- Bera test in which the probability value is zero for each variable .
2. The distribution of random term is normal for separate bank but is none normal when the data is pooled this result ascertains the need of generalized regression estimation.
3. Running fixed effected revealing near singular matrix so the estimator was broke down.
4. Random effect Hausman test assured the suitability of such regression to the study model.
5. The constant term is negative in pooled ordinary regression and in random effect regression which ascertain the diminishing profitability of Sudanese commercial bank in the long run.
6. Assets and liabilities directed bank profitability positively, while the statistics demonstrated the sensitivity of profitability toliabilitiessomuch than assets.
7. Foreign ownership of Sudanese commercial bank contributed positively to bank profitability as demonstrated by ordinary pooled regression and random effect regression.
8. Maturity of bank contributes positively to bank profitability as demonstrated by random effect regression and negatively as demonstrated by pooled ordinary regression.
9. Lumpy capital contributes negatively to commercial bank profitability as demonstrated by ordinary pooled regression and random effected regression.
10. Investment and capital bank, Al-Barka bank, Khartoum Bank, United capital bank, Industrial development bank experienced negative contribution to the profitability as demonstrated constant cross section coefficients.
11. Sudanese jurdian Gazera bank, Elshamal bank, Bule Nile Mashraque bank, Faisal Islamic bank experienced positive contribution to profitability as demonstrated constant cross section coefficients.
12. Coefficient of determination as demonstrated by R square and adjusted R square is comparatively high with significant F test in both ordinary pooled regression and random effect regression.

13. Durbin – Watson value is low in ordinary in ordinary pooled regression whilecomparatively high in random effect regression which comparatively assures the existence of negative auto cumulative in ordinary pooled regression estimation but none assured in random effect estimation.
14. Out of five commercial bank experienced negative contribution to profitability three are immature, three have lumpy capital and three were foreign owned equities.
15. Out of four commercial bank experienced positive contribution to profitability two are immature two has established lumpycapital and three are foreign owned equities.
16. Industrial development bank has largest negative contribution to profitability while Fiasal Islamic bank has largest positive contribution toprofitability. The formerbank characterized by immaturity, lumpy established capital in addition local owned equities, while the latter is characterized by maturity, lumpy established capital and foreign owned equities.

VII. Concluding Remarks

1. Random effect regression is suitable technique to manipulate the panel data of the study because the results were revealed none –normal distribution of error term and the data matrix is near singular when fixed effect regression was run.
2. Long run profitability if the Sudanese bank is diminishing demonstrated by constant term and the majority of cross section constant terms of each bank.
3. Profitability of Sudanese commercial bank is more sensitive to the liabilities than the assets which reflect either proper use or misuse to the liabilities.
4. Foreign investment in commercial banks proved competency in managing the business compare to local or domestic ones (efficient management i.e economics of scale).
5. The experience of the commercial bank measured by the age of the bank plays crucial role in gaining the advantage of the business i.e. more profit.
6. Lumpy started capital in commercial bank businesses worse of the term of businesses as result of diseconomies of scale (Mal-management).
7. From the sample banks who started as public ownership after privatization experienced high negative profitability while the commercial bank who started as private ownership experienced large positive profitability,this demonstrated that the private sector is more preferential in bank business compare to public one.
8. Acceptance of random effect estimator ascertained uncorrelated unobserved effects with the main explanatory variables and the dummy variables made the matter better off.

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