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Abstracts

The primary aim of this paper to evaluate the cost of deposit insurance premium and assess moral hazard effect in the banking sector in Sudan. The analysis of moral hazard in this paper is based on two types of risks, credit default risk, measured as the ratio of non-performing loans to the total size of loans for each bank, and operational risk measured as technical inefficiency. The findings of the research indicate there is a positive association between insurance coverage premium and increase in each of these two risks, implying evidence of moral hazard effect. A policy implication of this result is that the moral hazard behavior in the banking sector can be mitigated by changing the current policy of flat rate deposit insurance premium to risk based insurance premium policy.

Keywords: Deposit; Insurance; Moral hazard; Risk.

1- Introduction:

Due to recurring global financial crisis during the past fifteen years, deposit insurance system attracted increasing attention of policy makers in developing and developed countries. As a result in the past decade increasing number of countries around the globe have adopted deposit insurance system as part of their financial safety network. Countries that adopt explicit insurance make decisions about which class of deposits to insure, and up to what amount, which banks should participate in the insurance, and at what levels insurance premiums should be set, and how to manage the deposit insurance fund (table 1). Explicit deposit insurance is a response to the increasing problem of banks run and contagion. Banks are susceptible to contagion because they borrow short by accepting demand deposits and lend long by extending loans with longer maturities. If depositors decide to withdraw more cash than the bank has in the vault, the bank may

not be able to liquidate its assets fast enough to satisfy deposit demands, and as a result a bank run can be prompted. Deposit insurance aims to assure depositors that if their banks fail for any reason, their funds will be protected up to the limits on coverage.

Unless a bank can preserve liquidity, it may find itself forced to sell off its assets at low prices or close its doors. But with presence of deposit insurance , the psychology of a bank failure can be mitigated as depositors feel protected by the insurance system. However, deposit insurance system is not without costs, as it may encourage banks to take extra risks as a result of insurance protection, or what is called moral hazard problem.

This paper aim to assess the pricing of deposit insurance in a sub-Saharan African country that adopted the system of deposit insurance in the past few years. The academic basis for pricing deposit insurance goes back to Merton (1977) who modeled deposit insurance as a put option on the value of a bank's assets. Deposit insurance is considered over-priced (under-priced) if the deposit insurer actually charges more (less) for its insurance service than the cost of these services.

This paper aims to extend the empirical literature in two ways: First, the existing empirical evidence on deposit insurance pricing tend to focus on banks in developed countries whose banking system at widely different stages of liberalization and sophistication. There is a limited evidence of deposit insurance pricing in developing countries. Second, the Islamic banking system is distinct from conventional banking system, as a result, risk taking in such environment is different. This paper aims to fill part of this void by taking banking system of different environment and at different sophistication level.

2- Literature review:

In the past decade a number of research papers investigated the effectiveness of deposit insurance on risk control in banking sectors across different countries. Demirguc-Kunt

and Huizinga (1999) show empirical evidence that explicit deposit insurance increases bank crisis in countries with weak regulatory institutions. Similarly, Cull, Senbet, and Sorge (2000) argue that for explicit deposit insurance to sustain financial stability it has to be accompanied by a sound regulatory scheme. Kane (2000) explains that the design of deposit insurance systems should incorporate that country specific factors in particular, differences in informational environment and transparency and enforceability of regulations. Laeven (2002b) indicate that the opportunity cost of deposit insurance services is higher in countries with explicit deposit insurance as compared to countries without explicit deposit insurance. Matutes and Vives (1995) and Dewatripont and Tirole (1993a) indicate that the degree of moral hazard depends on whether the performance of the bank is observable. When bank performance is unobservable, risk taking behavior is maximized even without deposit insurance. Matutes and Vives (1995), argue that if the performance of the bank are not observable, since depositors cannot differentiate between banks, they will charge interest rates that compensates them for maximum risk, and banks fulfill depositors expectation and assume maximum risk.

3- Deposit insurance in Sudan:

As part of policy package aiming to establish stable financial environment in the country the Central Bank of Sudan adopted in the past decade a number of policies, among which establishing Banks Deposit Security Fund (BDSF) in 1996, with paid-up capital of one hundred million Sudanese Dinars (equivalent to 40 million US$), in addition to annual fees of 0.03% of total deposits of each bank operating in the country payable to BDSF as insurance premium. Currently, the annual insurance premium is flat rate applicable to all member banks, regardless of their risk levels. Table (1) includes summary of deposit insurance systems in Sudan and two other countries in the region for comparison purpose.

To enhance financial environment the Central Bank also implemented a policy of restructuring the banking sector, by raising banks capitalization, through implementation

of optional and mandatory mergers between a number banks some of them were on the verge of financial collapse[1]. Since credit risk is the major source of financial risk in the banking sector in the country, the central bank's regulation gave substantial space to credit risk control and monitoring. To reduce default risk the Central Bank stipulated a upper ceiling to bank loans at a level of 2.5% of the bank paid up capital to each single investor or borrower. To establish a comprehensive data base on bank loans the central bank adopted electronic code system that help monitoring the financial status of borrowers before any new loan transactions take place, and to help forming data base about NPLs of each bank. The Central bank also established Credit Rating Agency that help in disclosing financial transparency and credit worthiness of borrowers of the banking sector. The Central Bank also set regulations about risk management departments in banks, corporate governance systems, as well as regulations related to organizing mortgage and asset valuation policies in the banking sector in the country.

4- Methodology:

4.1 Pricing deposit insurance:

In the literature several methods have been developed to price deposit insurance. Many of these methods are based on Merton (1977) option pricing model that portrays deposit insurance as a put option on the bank's assets, as indicated in the following specification:

$$p(d,\sigma^2) = \varphi(h_2) - \frac{1}{d}\varphi(h_1)$$

Where

$$h_1 \equiv \left\{\log(d) - \frac{\sigma^2}{2}\right\} / \sqrt{\sigma^2}$$

[1] The merger of Gadaref bank with Saving bank was mandatory, but the mergers of Mashreq and Blue Nile banks, and Khartoum with Emirate bank were optional.

$$h_2 \equiv h_1 + \sqrt{\sigma^2}$$

Where p is the price of deposit insurance per dollar of insured deposits, φ is the cumulative normal distribution function, d=D/v is the current deposit-to-asset value ratio, and σ^2 is the variance of the logarithmic change in the value of the assets during the term of the deposits. This implies that as long as the deposit-to-asset ratio and the volatility of the assets remain fixed, the cost of deposit insurance is constant.

4.2 Technical Efficiency :

Several alternative DEA models have been employed in banks efficiency literature. In this paper we employed two alternative DEA models. We use the CCR (Charnes, Cooper, and Rohdes, 1978), and BCC (Banker, Charnes, and Cooper, 1984) models. The main objective of a DEA study is to project the inefficient decision making units ($DMU_{s)}$ onto the most efficient frontiers of the DMUs in the sample, under the assumptions of change in return to scale and constant return to scale. There are two directions, input-oriented approach that aims at reducing the input amounts by as much as possible at a given level of output and the output-oriented, approach that maximizes output levels at a given input level.

In vector-matrix notation the input-oriented CCR model, with a real variable θ and a non-negative vector $\lambda = (\lambda_1,..\lambda_n)^T$ of variables can be expressed as:

(LP_0) min θ (1)

subject to

$$\theta x_0 - x\lambda \geq 0 \quad (2)$$

$$Y\lambda \geq y_0 \quad (3)$$

$$\lambda \geq 0 \quad (4)$$

Where y_0 and x_0 are respectively the output and the input levels related to the specific DMU_0 under investigation, and Y and X are matrices constituting all output and input variables. The objective function in equation (1) minimizes the input level, whereas the constraints in equations (2) and (3) constrain the minimization of input within feasible region, and equation (4) stipulates non-negativity constraint the input and output weights.

The problem (LP_0) has a feasible solution at θ=1, $\lambda_0 = 1$, $\lambda_i = 0$ (j≠0). Hence the optimal θ, denoted by θ^*, is not greater than 1. On the other hand, due to the nonzero assumption for the data (X and Y), the constraint (4) forces λ to be nonzero because y_0>0. Putting all this together, we have $0 < \theta^* \leq 1$.

The input-oriented BCC model evaluates the efficiency of DMU_0 (0=1,...n) by adding to the constraints in (2) – (4), the new constraint $e\lambda = 1$, and solving for the minimum objective function in equation (1).

When the BCC model is taken into account, the overall technical efficiency includes, the pure technical efficiency, which denoted as σ_i, and the scale efficiency which is

$\pi_i = \theta_i / \sigma_i$. Thus, the fraction of output lost due to scale inefficiency can be computed as $(1-\pi_i)$. Scale inefficiency can arise due to variable (increasing or decreasing) return to scale. On the other hand, pure technical inefficiency occurs because a DMU uses more inputs than needed (input waste), whereas scale inefficiency occurs due to reasons that DMU is not operating at constant return to scale. To account for variable return to scale we employ BCC model, so that at scale efficiency $\theta^* = 1$, for both CCR and BCC models, but for $\theta < 1$, for CCR, and $\theta^* = 1$ for BCC, indication of scale inefficiency but pure technical efficiency. Pure technical inefficiency can be due to inefficient implementation of the production plan in converting inputs to outputs (managerial inefficiency). However scale inefficiency could be due to divergence of DMU from the most productive scale size. Therefore decomposing technical efficiency into pure technical and scale efficiencies allows us to gain insight into the main source of inefficiency in Sudanese banks.

5- Empirical analysis:

Data employed in this study taken from financial statements of 23 banks (foreign and local) operating in the country during the period 2010-2011. To estimate deposit insurance price based on Option pricing model, we used total deposits and total assets – sum of loans and cash- as variables in the equations. Table (1) includes our estimation results which indicates that the flat rate of 0.3 percent of the deposit insurance premium, under-value the insurance cost for about 14 banks among the 23 banks in the sample. Under-valued deposit insurance premium could induce moral hazard problem to the Deposit Security Fund and weaken its financial position. Table (2) report the technical efficiency results that reveal operational risk measure and scale inefficiency. Results in table 2, indicates that the technically efficient banks in the group are three foreign banks: Sudani-Egyptian, Almal, and Qatar bank, while almost all national banks below the efficiency level of the unit scale.

It is well documented that in countries with weak institutions and improper regulatory safeguards, explicit deposit insurance reduce incentives by depositors and shareholders to monitor their banks, and also give insured banks incentive to take additional risk as long as they can shift the added losses to deposit insurer[2]. This problem is known as moral hazard effect of deposit insurance. To test for moral hazard in the banking sector in this paper we performed cross sectional regression analysis using two types of risks as dependent variables and deposit insurance coverage as independent variable. The first risk in our case is credit risk, as measured by non-performing loans for each bank during 2011, whereas the second risk is the technical inefficiency risk measured by the DEA, CCR model. Table (4) indicates estimation results that reveal a positive association, even though insignificant, between credit risk and deposit insurance coverage. This result imply the flat rate insurance premium policy employed by the Bank Deposit Security Fund (BDSF) instigates moral hazard effect at banks level, even though the effect is insignificant statistically. However, the influence of deposit insurance on technical efficiency is negative, implying higher levels of insurance coverage decrease the efficiency of banks. In fact, the result of negative association between coverage level and technical efficiency is consistent with the moral hazard behavior associated with the positive association between insurance coverage and credit risk, because lower technical efficiency imply higher operational risk. As a result, both results support an evidence of correlation between moral hazard effect and higher insurance coverage. The problem of insignificance of the coefficients of the independent variable in both cases is likely due to flat rate insurance premium that results in under priced insurance premium for a bout half of the number of banks in the sample[3].

[2] See Asli D., and Kane E., (2002).

[3] The insignificance problem of the coefficients could be resolved by including larger sample size of banks and run a separate regression on the group of banks with under-priced insurance premium.

Table (1): Deposit insurance price

Bank	P	Bank	P
Khartoum	0.002	Islamic-Sudanese	0.021
Neleen	0.088	Savings	0.043
Omdurman	0.008	Real estate	0.127
Animal Resource	0.130	Abu-Dhabi	0.017
Al-Shamal	0.022	Beblose	0.004
Farmers	0.003	Sudanese-Egyptian	0.001
Tadamon	0.003	AL-Salam	0.0003
Fisal	0.0002	Industrial Dev.	0.110
Sudanese-Saudi	0.131	Al-Mal	0.014
French-Sudanese	0.020	Algazera	0.002
Labors	0.001	Qatar	0.002
Export	0.019		

P= insurance premium cost per a Sudanese pound in bank's deposit.

Table (2): Technical efficiency

Bank	CCR	BCC	Scale	Bank	CCR	BCC	Scale
Khartoum	0.50	1.00	0.50	Islamic-Sudani	0.56	0.56	1.00
Neleen	0.92	0.96	0.95	Savings	0.47	0.50	0.94
Omdurman	0.38	1.00	0.38	Real estate	0.82	1.00	0.82
Animal Resource	0.49	0.53	0.92	Abu-Dhabi	0.92	0.94	0.97
Al-Shamal	0.45	0.47	0.95	Beblose	0.57	0.58	0.98
Farmers	0.70	0.77	0.90	Sudani-Egyptian	1.00	1.00	1.00
Tadamon	0.51	0.77	0.66	AL-Salam	0.88	1.00	0.88
Fisal	0.55	1.00	0.55	Industrial Dev.	0.89	0.93	0.95

Sudani-Saudi	0.31	0.40	0.77	Al-Mal	1.00	1.00	1.00
French-Sudani	0.48	0.52	0.92	Algazera	0.64	1.00	0.64
Labors	0.69	0.88	0.78	Qatar	1.00	1.00	1.00
Export	0.81	0.82	0.98				

Notes:

1- Scale efficiency computed as the ratio of CCR to BCC .
2- Efficiency results are based on 2011 data.

Table (4): Moral hazard effects

Dependent variable	Independent variable (Deposit insurance)	
Credit risk	$\propto_0$	0.001
	(p-value)	(0.98)
	$\propto_1$	0.035
	(p-value)	(0.77)
	R^2	0.04
	LM	27.4
Efficiency	β_0	0.69
	(p-value)	(0.00)
	β_1	- 0.072
	(p-value)	(0.39)
	R^2	0.035
	LM*	8.45

*LM test for cross section heteroskedasticity.

6- Concluding remarks:

To price deposit insurance premium and assess moral hazard behavior in the banking sector in Sudan we used financial data for 23 banks, national and foreign banks, operating in the country in 2011. We applied Merton (1977) options pricing model to price deposit insurance premium .To assess moral hazard effect we estimated two types of risks, credit default risk, measured as the ratio of non-performing loans to the total size of loans for each bank, and operational risk measured as technical inefficiency estimated using Data Envelopment Analysis (DEA). Our findings indicate that there is a positive association between insurance coverage premium and increase in each of these two risks. The results of positive association between insurance coverage and the two risks imply evidence of moral hazard effect. A policy implication of this result is that the moral hazard behavior in the banking sector can be mitigated by changing the flat rate deposit insurance premium policy currently practiced into risk based insurance premium policy.

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Appendix: Deposit Insurance Systems

	Sudan Law	Bahrain Law	Jordan Law
Board of Directors	1- The Governor of the Central Bank. 2- The General Manager of the deposit insurance fund 3- Deputy Minister of Finance & National Economy 4- Director of the department of banks regulation at the Central Bank. 5- Two members elected by the Association of commercial banks 6- Two experts in banking chosen by the Minister of Finance & National Economy	1- Two experts nominated by the Governor of the Monetary Agency 2- Four members representing commercial banks nominated by the Governor of the Monetary Agency 3- A representative from each of: Ministry of Finance, Ministry of Justice and Islamic Affairs, Ministry of National Economy and Trade. 4- A representative from a bank under liquidation.	1- Governor of the Central Bank (Chair) 2- Deputy Governor of the Central Bank 3- The General Manager of the Deposit Insurance Fund 4- Two members from the Ministry of Finance, and the Ministry of Trade 5- Two members appointed by the Council of Ministers.
Membership	All licensed commercial banks operating in the country.	All licensed commercial banks operating in the country except those insured elsewhere outside the country.	All commercial banks operating in the country, with exception of branches of Jordanian banks operating outside the country.
Annual fees	Insured member pay annual fee of the rate 0.003 of its total current and saving accounts. And also 0.003 of its total investment account.	Annual fee of 25 million Dinars divided between insured banks, based on proportion of each bank's deposits.	Annual fee of 0.0025 of the total insured deposits, and possibly a higher rate for banks with higher risks, or when under liquidation.
Initial paid-up capital	1- 25 Million Sudanese Dinars paid by the Ministry of Finance 2- 40 Million Dinars by the Central Bank 3- 1 Million Dinars by each member bank.	No initial capital payment .	1- One Million Jordanian Dinars paid by the Government 2- 100,000 Dinars paid by banks as initial capital fees.