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Ordinary Least Square and Vector Autoregressive analysis of Forward Integration Credit Risk Mitigation Mechanisms by Commercial Banks on Capital Employed growth of Agribusinesses in Kenya

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Abstract

Capital growth is long-term return expectations on a balanced fund; where time is required to facilitate determination of compounding and diversification functions of Capital Employed on itself; not only for the lender firms but also for the borrower firms.Lack of specific sector based information on employment of Forward Integration Credit Risk Mitigation Mechanisms (FICRMMs) and borrower business capital growth, and the declining credit trends to the agribusiness sector despite its contribution to the GDP; coupled with the fact that credits are critical for business financing and productivity; as an instrument of growth in Capital Employed, set the basis for this paper. Using time series data of 43 firms for 2003-2014, it was established that OLS gives an R2 of 0.532 while the lagged VAR results give an R2 of 0.651 for capital growth, significant at p<0.05; revealing that over time, the explained variable is affected by its own lagged evolution and the lags of other endogenous variables, thereby accounting for 65.1% of capital growth. Hence H0: r=0 is rejected and H1: r≠0 is accepted.FICRMMs are significant for agribusiness capital growth, both at single and lagged period; although credit issuance to the sector is generally low.

Key words: Capital growth, Forward Integration

1.Introduction

Capital employed, commonly referred to as Invested Capital is the sum total of all resources invested in an enterprise, net of Current liabilities, short term debts and accumulated depreciation [1]. Investors looking to achieve long-term capital growth have one great advantage − time. Money invested generates returns that can be reinvested to achieve further returns (this process enables compound growth). Given that compounding is an exponential rather than a linear function, the longer investors have to invest the greater the possibility of dramatically multiplying their purchasing power. When investing to fund a retirement, investors' investment horizons are measured in decades rather than years. This makes optimal decision-making counter-intuitive to the short-termism that drives most market participants [2].[3]states that determination of the influence of credit risk mitigation mechanisms on capital growth given reveals the borrowers' deeper investment potential, while for the lender, it shows the credit market potential.Capital growth is therefore long-term return expectations on a typical balanced fund.Time is therefore required in a business operation to facilitate determination of compounding and diversification functions of Capital Employed on itself; not only for the lender firms but also for the borrower firms.[4], on Capital Growth; Theory and Practice explain that "in capital accumulation under uncertainty, a decision-maker must determine how much capital to invest in riskless and risky investment opportunities over time;" since investment strategy yields a stream of capital, with investment decisions made so that the dynamic distribution of wealth has desirable properties over time.

1.2 Statement of the Problem

Forward Integration Credit Risk Mitigation Mechanisms perfectly explain the growth in Capital employed, since they are all significant, its moderate coefficient of determination need the establishment of other contributory factors.The role of credit financing in improving business capital for expanded business functions and growth in capital employed, and the decreasing credit trends raises the need to analyse the contribution of the Forward Integration Credit Risk Mitigation Mechanisms to the growth index of the agribusiness capital employed.The disconnect of the Commercial banks' employment of Forward Integration Credit Risk Mitigation Mechanisms (FICRMMs) to expand credit access and demand, and the declining credit trends to the agribusiness sector despite its contribution to the GDP; coupled with the fact that credits are critical for business financing and productivity; as an instrument of growth in Capital Employed, requires attention.Furthermore, there is limited information on the effect of the credit supply side operations

that influence the credit demand side for the region under this study. Neither are there studies specific to agribusiness sector financing risk mitigation, examining the variables under this study for the region.

2.Literature Review

[4], on Capital Growth; Theory and Practice explain that "in capital accumulation under uncertainty, a decision-maker must determine how much capital to invest in riskless and risky investment opportunities over time;" since investment strategy yields a stream of capital, with investment decisions made so that the dynamic distribution of wealth has desirable properties over time. The distribution of accumulated capital to a fixed point in time and the distribution of the first passage time to a fixed level of accumulated capital are variables controlled by the investment decisions."A company's return on capital employed (ROCE) is calculated by dividing its earnings before tax and interest (EBIT) by its total capital employed and company's return on assets (ROA) showing how much money in earnings a company derives from each unit Shs 1 of assets that it owns; giving the idea of how efficient the company is at turning what it owns into profit. Both these ratios worked over time gives the extent of capital growth; whether positive or negative [5]. [6], states that when determining a firm's internal capital requirement, the bank should establish an approach to risks and risk management, with an orientation to borrower firms' capital growth. The risk management strategy should therefore be revised regularly and its content communicated within the organisation so as to enable the organisation to comply with the changing operating conditions. [7] explains that a credit model that is innovatively designed to promote borrowing, and at the same time secure default risk, helps small and medium scale business firms to grow their capital base; and consequently enable them to acquire a consistent but controlled development. Kargi [8] established that credit risk management has significant impact of profitability of banks as lenders, and subsequently asserts that this condition arises from increased loans and advances to the borrower firms resulting into borrowers' capital growth, Return on equity and Profit after tax. Kosmas [9] concludes that the borrower- side management is mandatory for survival and growth of the credit market.

However a majority of the literature does not relate to specific sectors' performance measures; and are commonly analysed on the basis of expected rather than actual firms' return. Subsequently it becomes necessary to assess the effect of credit risk mitigation mechanisms not only on Return on Equity and Return on Assets, but also how the mitigation mechanisms impact on the growth of Capital Employed in the in specific critical sectors of the economy, such as the agribusiness sector.This scanty information leaves a gap that requires deeper sector specific designed study to check the effect of Forward Integration Credit Risk Mitigation Mechanisms on Capital employed and return on equity; hence the orientation of this study to the agribusiness sector.[3], in his study of Imperfect Information, Social Capital and the poor access to credit, established that well documented interrelations between the lender and borrower and quality between lender and borrower organisations as important in credit risk management, borrower business returns, productivity and sustainability. He says that determination of the influence of credit risk mitigation mechanisms on capital growth given reveals the borrowers' deeper investment potential, while for the lender, it shows the credit market potential. [7] explains that a credit model that is innovatively designed to promote borrowing, and at the same time secure default risk helps small and medium scale business firms to grow their capital base; and consequently enable them to acquire a consistent but controlled development. [8], established that credit risk management has significant impact of profitability of banks as lenders and subsequently asserts that this condition arises from increased loans and advances to the borrower firms resulting into borrowers' capital growth; which facilitates Return on equity and Profit after tax.

[9]Concludes that the borrower- side management is mandatory for survival and growth of the credit market. The challenges of lending to small and medium scale enterprises, which are ultimately in their growth stages, where credit financing is critically required to facilitate growth and the available literature pointing to positive effect of Credit Risk Mitigation on capital growth, but in general and non- focused on specific sector-to-sector performance, provides need for investigation. This insufficient information level leaves a gap for sector based analysis and or deeper sector specific designed study to ascertain how the Forward Integration Credit Risk Mitigation Mechanisms influence changes in Capital employed; hence the orientation of this study to the agribusiness sector.

In a primer on the role of financial services on the development of agribusiness, [10]developed to help Land O'Lakes staffers become more familiar with the importance of financial services which serve as a catalyst for rural and agribusiness development; financial concepts especially as applied to rural finance; individual financial products and financing strategies that incorporate multiple products and factors that enable or impede proper development of financial services; and the role in development organizations, draws a conclusion that credits enable both development activities and the optimal use of excess liquidity within a community through capital formation and intermediation. Subsequently a review of agribusiness fluctuations in terms of trade in agriculture shows an increased need for short and long–term finance in agriculture and agro-industries [11]. The review identifies lack of capital as a commonly

hampering the attempts to increase productivity, leading to the use of inappropriate machinery and equipment and restricting the use of favorably productive inputs. This implies that credit risk volume significantly affects the agribusiness performance and growth in investment capital. As a result, there is a need to investigate the credit system and the lenders' demonstration of effective employment of credit risk mitigation mechanisms and how this has influenced credit access.

The results of a study by [12]; whose objective was to determine fund access by Small and Medium size Enterprises (SMEs) from the commercial banks in Singapore, and effect on those firms' capital growth, provide significant correlation coefficients in which the key ones were public insurance, commercial insurance, portfolio diversification and clients based information management as the key risk mitigation practices alongside securitization investment guarantees, credit enhancement and derivatives. Notably, majority of these agribusinesses operate within the SME category. The study concludes that more effective mitigation of risk categories would enable an increase in private sector capital flow to the emerging markets, and that new investments have greater need for risk mitigation than established ones and that investment portfolio approach absorbs risk effects to manageable levels to post improved profits and capital growth. Credit risk management has significant impact on profitability of banks as lenders and subsequently asserts that this condition arises from increased loans and advances to the borrower firms resulting into borrowers' capital growth, Return on equity and Profit after tax [8].The fact that Credit Risk Mitigation Mechanisms applied by a majority of the Commercial Banks have not distinguished the specific environmental or sectoral orientation; and that the application of standardized Credit Risk Management parameters fail to recorgnise sectors' dynamics, and the absence of a well-functioning sector to sector credit systems that help define suitable credit product lines despite the apparent positive correlation between the Forward Integration Credit Risk Mitigation Mechanisms parameters to access and capital growth, whereas a number of studies also focus on the role of Credit Risk Management on discouraging default behaviour; they critically fail to examine the borrower side benefits or performance; making it necessary to determine the effect of credit risk management on growth of capital employed of specific sectors of the economy.

3.Methodology

Stratified random sampling was used to select appropriate sample size of 45 firms, focusing on objectivity in selecting a sufficient number of subjects from each stratum, thereby providing a sample size which is fairly representative of the population's characteristics.

Hence, the sample size for agro-processing= 19.6, ≈ 20 while for farm based agribusinesses = 25.3, ≈ 25; bringing the total to 45 firms. These gave a framework of (45×10×4) = 1800 observation.

3.1. MODEL SPECIFICATION

This study adopted a vector autoregressive model to describe the existing relationship between and among the variables under investigation. The Vector Autoregressive (**VAR**) model is based on time series data [13]; where the current values of each one of the variables in the model are expressed as functions of past values of the same variables. In our current case where four variables have been identified (on *a priori* basis, the four are relevant and significant in their contributions) the values of each one of the four factors/variables at the current time **"t"** is affected by past values of all the four variables in the system. The equation with z_t as the dependent variable is represented in the following general functional form.

$$z_t = f(z_{t-i}, x_{t-i}, y_{t-i}, w_{t-i}, u_{t-1}\varepsilon_t) \qquad t = 1,2,...,T; \quad i = 1,2,...,k \tag{3-1}$$

Where

$x_t = Portfolio\ Diversification$

$y_t = Information\ Managemnt$

$w_t = Credit\ Insurance$

$u_t = Technical\ Assisance$

$z_t = Capital\ Employed\ Growth$

The dimensions of the subscripts in the general equation (3-1) suggest that the model is a **VAR (k)** model, based on **"T"** periods. In other words, the model is a vector autoregressive model of order **"k".**

To avoid the use of a disproportionately large number of parameters in the **VAR** model, we shall specify a model with two time lags. This gives us the following vector autoregressive model of order two, symbolically represented by **VAR (2).**

$$z_t = a_{51}x_{t-1} + a_{52}y_{t-1} + a_{53}w_{t-1} + a_{54}u_{t-1} + a_{55}z_{t-1} + b_{51}x_{t-2} + b_{52}y_{t-2} + b_{53}w_{t-2} + b_{54}u_{t-2} + a_{55}z_{t-2} + \varepsilon_{5t} \quad (3\text{-}2)$$

This model can be presented in vector format which yields a compact form of the model.

4.Results Discussions

Table 4.1 Correlation Results between Forward integration Credit Risk Mitigation Mechanisms and Growth in Capital Employed

Correlation	CAPEMGR	CREDINS	INFMGT	PORTDIV	TECHASS
CAPEMGR	1.0000				

CREDINS	0.680516**	1.0000			
	(0.0000)	-----			
INFMGT	0.829072**	0.800431**	1.0000		
	(0.0000)	(0.0000)	-----		
PORTDIV	0.627022**	0.440100**	0.645224**	1.0000	
	(0.0000)	(0.0000)	(0.0000)	-----	
TECHASS	0.784481**	-0.127271**	0.514710**	0.799084**	1.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	-----

Note: The p values are in parenthesis. ** Significant at 1% i.e. α= 0.01. Source: Research Data 2014
Since beta (β) coefficients are positive CREDINS, INFMGT, PORTDIV and TECHASS have a positive correlation with CAPEMGR. Capital Employed Growth increases when the Forward Integration Mitigation Factors increase; and subsequently decreases when the factors decrease. Notably, all the four explanatory variables significantly contribute to Capital growth, with p = 0.0021< 0.0500 for credit insurance (CREDINS), p = 0.0000<0.0500 for credit information management (INFMGT), p = 0.0002<0.0500 for credit portfolio diversification (PORTDIV) and p = 0.0000 <0.0500 for technical assistance (TECHASS).

4.2. EFFECT OF FORWARDINTEGRATIONCREDITRISKMITIGATIONMECHANISMS ON GROWTH OF CAPITAL EMPLOYED

The model is estimated by use of OLS, significant at1% and 5%. The data used in this analysis is based on the quarterly observations of the five variable for the 43 firms (i.e. 43×4×10 years = 1720 observations).

TABLE 4.2: FORWARD INTEGRATION CREDIT RISK MITIGATION MECHANISMS ON CAPEMGR

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-11.64509	0.730156	-15.94877	0.0000
C(2)	0.326278	0.105921	3.080376	0.0021
C(3)	1.097259	0.063561	17.26295	0.0000
C(4)	0.398010	0.105239	3.781963	0.0002
C(5)	0.897298	0.137560	6.522948	0.0000
R-squared	0.531022	Mean dependent var		4.632880
Adjusted R-squared	0.519438	S.D. dependent var		5.853476
S.E. of regression	4.828893	Akaike info criterion		5.990014
Sum squared resid	39990.73	Schwarz criterion		6.005858
Log likelihood	-5146.412	Hannan-Quinn criter.		5.995876
F-statistic	202.7137	Durbin-Watson stat		2.000968
Prob(F-statistic)	0.000000			

Dependent Variable: CAPEMGR; Method: Least Squares; N=1720. Source: Research Data 2014
Sample (adjusted): 6 1720
Included observations: 1715 after adjustments
Note: C(1)= Constant, C(2), C(3), C(4) and C(5) are coefficients of the tested variables
CAPEMGR= C(1)+C(2)*CREDINS+C(3)*INFMGT+C(4)*PORTDIV+C(5)*TECHASS

From the results in Table 4.2 the following model equation 4.1 can be deduced;

$$Capemgr = -11.6451 + 0.3263 credins + 1.0973 \inf mgt + 0.3980 portdiv + 0.8973 techass \quad \textbf{(4.1)}$$

The findings indicate that the model is valid since the p value p= 0.0000< α – level of significance where (α = 0.0500), and also confirmed by the F-statistics = 202.7137. From the findings, all the independent variables are statistically significant both at 1% and 5%. A unit increase in Credit Insurance C(2) increases predicted Capital employed growth level by 0.3263 percentage points (i.e. 32.6%) at p< 0.05 significance level. This implies that Credit Insurance significantly contribute to Capital employed growth. It is observable that although credit insurance yields positive significant contribution to capital growth, the magnitude is fairly low. A one percentage increase in information management C (3) increases predicted Capital employed growth levels by 1.0973 percentage points (i.e. 109.7%) at p< 0.05 significance level. This implies that Credit Information Management's contribution to agribusiness Capital employed growth is significant. It is also observable here that Credit Information Management highly contributes to agribusiness Capital employed growth, as shown by the magnitude of its coefficient. However a unit increase in Credit portfolio Diversification C (4) results into increase of predicted Capital employed growth levels by 0.3980 percentage points (i.e. 39.80%) at p< 0.05. This implies that Credit Portfolio Diversification significantly contributes to agribusiness capital employed growth, but with a fairly low magnitude. Subsequently a unit increase in Technical Assistance C (5) increases the predicted profit levels by 0.8973 percentage points (i.e. 89.73%) at p< 0.05. This implies that Technical Assistance significantly contributes to agribusiness capital employed growth by a higher magnitude. Similarly, the contribution of Technical Assistance and Credit Information Management to agribusiness capital employed growth are statistically significant and also have higher coefficients than Credit Insurance and Credit Portfolio Diversification, which although statistically significant, have a lower coefficients.

These represents a model of perfect fit, as all the independent variables significantly contribute to the dependent variable; unlike the Profit and Return on Equity models.

Therefore the Null hypothesis H_{05}: r = 0; forward integration credit risk mitigation mechanisms do not significantly contribute to capital employed growth is rejected and the alternative hypothesis H_{15}: r≠0; is accepted, that is, Forward integration credit risk mitigation mechanisms significantly contribute to capital employed growth of agribusiness enterprises in Nyanza region. Therefore all the four independent variables (i.e. credit insurance, credit information management, credit portfolio diversification and technical assistance) have a significant relationship with capital growth. This is evidenced by the p values of the coefficients of the variables, all at 0.00; in which case, p= 0.00 < α = 0.05.

The study findings as on Table 4.2 give an R^2 value of 0.531022 adjusted to 0.519438. This result implies that the independent variables explain the changes in capital (CAPEMGR) by up to 53.1022 %; leaving a 46.8978% to other factors not included at this level. Durbin-Watson statistics used to show auto-correlation among the error tools shows that there is no auto- correlation among the error tools as shown by the value 2.000968 which is approximately 2. This is accepted as the general rule of thumb for non- existence of auto- correlation. Further to note is the fact that analysed on their own to determine their effect on growth of capital employed, the model gives an R^2 of 0.531022, while when all the variables are set to a VAR equation the R^2 in respect of Capital growth moves to 0.685791 adjusted to 0.681148. This implies that CAPEMGR of the agribusiness operations is significantly influenced by all the variables under this study including itself. This can be seen reflected in the VAR model and VAR model substituted coefficients; which explain the exponential estimate of coefficients' contributions for each lag length.

[14], in a report of Commercial Banks' Risk Management, asserts that credit risk mitigation by the commercial banks improve the returns on asset as an indicator of capital growth and enables the lenders to avoid non- productive risks. This view is further propounded by [15], on a working risk management paper. They adduce a proposition that risk mitigants such as information management, risk transparency, portfolio management, credit insurance carried out through 3Ms (Micro, Macro Model) approach, would help the commercial banks to grow their credits and returns and also empower the borrowers to grow their business profits which in turn leads to growth in capital. This view is proximate to the findings of this study in respect of capital growth. Therefore there is need for the commercial banks to design a credit risk mitigation model that would over time reduce the uncertainties in the risk rating for credits granted to the agribusiness sector.

Therefore Forward Integration Credit Risk Mitigation Mechanisms' (FICRMMs) account for capital employed growth by 51.94%, implying that 48.06% of capital employed growth is accounted for by other factors outside the scope of this study. All the mitigation mechanisms significantly contribute to capital employed growth, except that the coefficient magnitudes for Credit Insurance and Credit Portfolio Diversification are fairly very low. Whereas the coefficient of

determination magnitude is average, there is a persistent need to reorganize the component parameters for Credit Insurance and Credit Portfolio diversification, to make them more focused on credit demand determination.

4.3. FURTHER DIAGNOSTIC TESTS

In order to test the validity and reliability of model 4.3, the diagnostic tests were made. The results from table 4.3 indicate that there was no presence of serial correlation and Heteroskedasticity in the error terms.

TABLE 4.3 SERIAL CORRELATION AND HETEROSKEDASTICITY TEST FOR CAPITAL GROWTH

F-statistic	428.1975	Prob. F(2,1713)	0.0000
Obs*R-squared	573.2865	Prob. Chi-Square(2)	0.0000
Heteroskedasticity Test: White			
F-statistic	5.077259	Prob. F(14,1705)	0.0000
Obs*R-squared	68.83715	Prob. Chi-Square(14)	0.0000
Scaled explained SS	345.5771	Prob. Chi-Square(14)	0.0000

Source: Research Data 2014

Variance Inflation Factors (VIFs) is a method of measuring the level of collinearity between the regressors in an equation. VIFs show how much of the variance of a coefficient estimate of a repressor has been inflated due to collinearity with the other regressors; that is the explanatory variables are linearly independent. The results in figure 4.8 also indicate that the residuals are normally distributed; since of the recursive residuals of quarterly return on capital growth index for the agribusiness firms for the period 2003 to 2013, for the 1720 observations on the 43 sampled firms range within 5.0% point ($-5.0 \leq t \geq 5.0$). Therefore the variables are normally distributed since they devolve around the mean or zero line over the period.

ABLE 4.4 MULTICOLLINEARITY TEST FOR CAPITAL GROWTH MODEL

Variance Inflation Factors

Variable	Coefficient Variance	Un-centered VIF	Centered VIF
C(1)	0.533127	39.32458	NA
C(2)	0.011219	11.39719	1.461270
C(3)	0.004040	19.59746	1.544719
C(4)	0.011075	18.88001	1.461929
C(5)	0.018923	40.89384	1.460264

Source: Research Data 2014

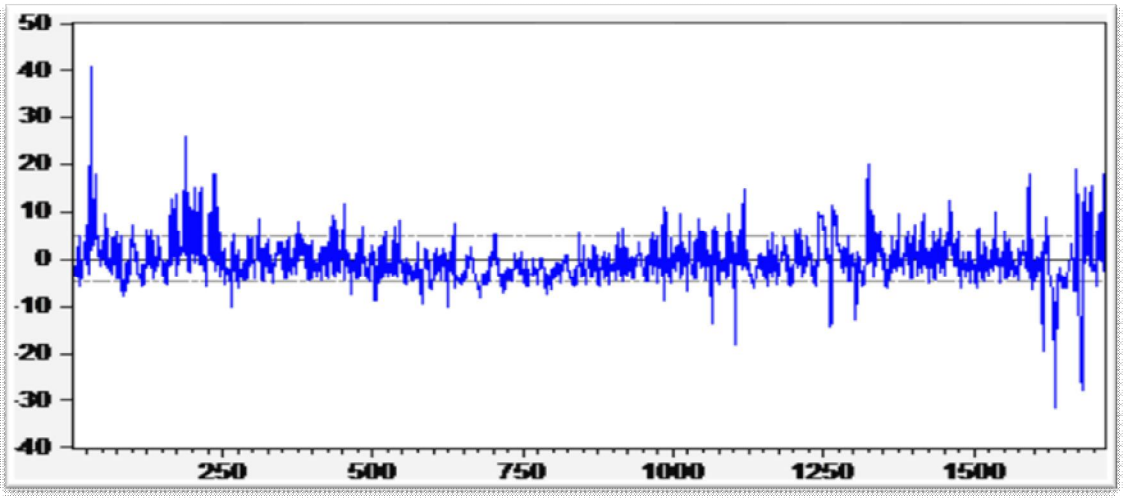

Figure 4.1 Residuals for CAPEMGR.

Source: Research Data 2013

The residual graph reveals a narrower range of capital growth movement as it evolves around the mean; reflecting a limited level of variability of the analysed parameters.

4.4 VECTOR AUTOREGRESSIVE MODEL

In order to determine dynamic relationships between variables, the study applied the Vector Autoregressive Analysis (VAR); due to its long tradition as tools for multiple time series and relative ease of working with, both in theory and practice as linear models. As Mukras (2012) notes, there are a number of issues that have to be taken into account in the process of estimating the VAR model, among them are a number of variables to be included in the model, lag length to be applied and the issue of stationarity/non stationarity. In this study, the number of variables to be included in models follows the finance theory of Risk versus Return for Investors, in which case the exogenous factors (as indicators of risk management) take the form of Forward Integration Credit Risk Mitigation Mechanisms while endogenous factors take the form of performance indicators. The stationarity of the variables having been secured at level and lag length determined at five (5) y
ears.

Table 4.5. Individual Unit roots Test for Stationarity

Variables	Augmented Dickey Fuller (ADF) Test		Phillips Perron (PP) Test		Inference
	Intercept	Intercept with Trend	Intercept	Intercept with Trend	
		Level			
CAPEMGR	-8.4592** (0.0000)	-8.5246** (0.0000)	-20.3071** (0.0000)	-20.3322** (0.0000)	I(0)
CREDINS	-13.5571** (0.0000)	-13.5531** (0.0000)	-32.5677** (0.0000)	-32.5656** (0.0000)	I(0)
INFMGT	-30.3589** (0.0000)	-30.3499** (0.0000)	-12.2857** (0.0000)	-12.2835** (0.0000)	I(0)
PORTDIV	-12.7130** (0.0000)	-12.7092** (0.0000)	-22.8614** (0.0000)	-22.8548** (0.0000)	I(0)
TECHASS	-36.3821** (0.0000)	-36.3705** (0.0000)	-9.1057** (0.0000)	-9.1038** (0.0000)	I(0)
		First Difference (Not further Required)			

Notes: The Null hypothesis is that the series has a unit root. The rejection of the null hypothesis for the DF and PP test is based on the Mackinnon critical values.** indicates the rejection of the null hypothesis of Unit root at 5% level of significance. Source: Research Data 2014

4.6.1 SPECIFICATION (CHOOSING THE LAG ORDER) AND ESTIMATION

One of the issues to be taken into account in the process of estimation of a VAR model is the Lag length (Mukras, 2012). The most common procedures for VAR order selection are sequential testing procedures and application of model selection criteria. Given a maximum reasonable order, say $p_{\max}$ for a VAR model and the following sequence, null hypotheses can be tested to determine the lag order $H_o : P_{\max} = 0$ e.t.c. The testing procedure stops and the lag order is chosen accordingly when the null hypothesis is rejected for the first time.

The standard model selection criteria which are used in this context choose the VAR order which minimizes them over a set of possible orders $m = 0,..., p_{\max}$. The general form of a set of such criteria is;

$$C(m) = \log \det(\hat{\Sigma}_m) + c_{T\varphi}(m) \qquad \textbf{(4.2)}$$

Where $\hat{\Sigma}_m = T^{-1}\sum_{t=1}^{T}\hat{u}_t u_t'$ is the residual covariance matrix estimator for a model of order m, $C_{T\varphi}(m)$ is a function of the order m which penalizes large VAR orders and c_T is a sequence which may depend on the sample size and identifies the specific criterion. The term $\log \det(\hat{\Sigma}_m)$_ is a non-increasing function of the order m, while $\varphi(m)$ increases with m. The lag order is chosen which optimally balances these two forces.

Table 4.6. Choosing the Lag order

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-16878.64	NA	74752.18	19.73556	19.78328	19.75322
1	-14732.96	4271.315	6159.848	17.23944	17.31578	17.26769
2	-14724.38	17.04408	6162.893	17.23993	17.34490	17.27878
3	-14709.52	29.47822	6120.846	17.23309	17.36668	17.28252
4	-14627.58	162.2567	5620.882	17.14787	17.31009	17.20791
5	-14518.26	32.31466*	4899.758*	17.01056*	17.22152*	17.10130*
6	-14510.55	15.21301	5006.811	17.03218	17.25165	17.11340
7	-14490.48	39.52949	4942.492	17.01925	17.26735	17.11106
8	-14474.04	216.0906	4999.264	17.03067	17.28729	17.11297

* indicates lag order selected by the criterion
Endogenous variables: PROFIT CAPEMGR ROE
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 4.6 indicates that the optimum lag length chosen is five. Lag length is the number of periods that a dependent variable in a regression model is held back in order to predict the dependent variable. If the lag length (p) is too small then the remaining serial correlation in the errors will bias the test. If (p) is too large then the power of the test will suffer. Therefore Monte Carlo experiments suggest it is better to error on the side of including too many lags. Using Monte Carlo simulation methods, under certain time-varying volatility specifications, standard information criteria, selecting too many lags has a significant negative effect on the power of the resulting unit root test.

The study estimated the **VAR** models by use of Ordinary Least Square (**OLS**). The only difference between the current and the previous estimation is that Vector Auto- Regression **(VAR**) is a system of simultaneous equations. Secondly, the variables have been categorized into endogenous and exogenous variables in the model. Lastly, the **VAR** allows for regressing each current (un-lagged) variable in the model on the lagged values of the same set of variables in the model [13].

In this study, the variable Capital growth (CAPEMGR) is assumed to be endogenous, while Credit Insurance (CREDINS), Information management (INFMGT), Credit portfolio diversification (PORTDIV) and Technical assistance (TECHASS) are exogenous variables. However Vector auto regression model assumes that all the variables are endogenous. Therefore, to avoid losing information, the variables are being regressed at levels represented by the lag order 1 to 5. The results of the estimates and summary of the statistics are shown in Table 4.6. Since the models have been confirmed to be stable and adequate the study is able to use them for estimation in the sections that follow.

The performance equation (Eq 3-1) with z_t as the dependent variable is represented in the following general functional form.

$$z_t = f(z_{t-i}, x_{t-i}, y_{t-i}, w_{t-i}, u_{t-1}\varepsilon_t) \quad t = 1,2,...,T; \quad i = 1,2,...,k \qquad \text{.....} \quad \textbf{(4.3)}$$

Table 4.7, Vector Auto- regression Estimates for all Variables for 5 lag lengths
Sample (adjusted): 6 1720
Included observations: 1715 after adjustments

Models	**1 TECHASS**	**2 ROE**	**3 PROFIT**	**4 PORTDIV**	**5 INFMGT**	**6 CREDINS**	**7 CAPEMGR**
CAPEMGR(-1)	0.006678	0.405343**	0.029259	0.026526	0.008854	0.013125	0.698377**
	(0.00133)	(0.02381)	(0.03848)	(0.00530)	(0.00706)	(0.00551)	(0.02478)
CAPEMGR(-2)	-0.000759	-0.088029**	-0.114720**	-0.004550	-0.049320	0.017880	-0.151940**
	(0.00157)	(0.02798)	(0.04523)	(0.00623)	(0.00830)	(0.00648)	(0.02912)
CAPEMGR(-3)	-0.008473	0.055076	0.062095	-0.007464	0.000674	-0.066857	0.059351**
	(0.00157)	(0.02803)	(0.04530)	(0.00624)	(0.00832)	(0.00649)	(0.02917)
CAPEMGR(-4)	0.013993	0.062041**	0.025697	-0.017776	0.070971	0.059905	0.260618**
	(0.00158)	(0.02830)	(0.04574)	(0.00630)	(0.00840)	(0.00655)	(0.02945)
CAPEMGR(-5)	-0.009883	-0.055392**	-0.014618	0.001010	-0.032776	-0.027192	-0.162268**
	(0.00137)	(0.02453)	(0.03965)	(0.00546)	(0.00728)	(0.00568)	(0.02553)
C	1.318212	4.272970**	7.129464**	0.086211	2.719123	2.811859	2.926620**
	(0.04585)	(0.81909)	(1.32385)	(0.18228)	(0.24301)	(0.18963)	(0.85246)

Models	**1**	**2**	**3**	**4**	**5**	**6**	**7**
R-squared	0.967557	0.816929	0.740280	0.699312	0.816222	0.671030	0.657675
Adj. R-squared	0.966881	0.813113	0.734866	0.693044	0.812391	0.664172	0.650539
Sum sq. resids	58.28759	18605.51	48602.24	921.4362	1637.681	997.2442	20152.62
S.E. equation	0.186321	3.328859	5.380254	0.740811	0.987619	0.770682	3.464499
F-statistic	1430.687	214.0663	136.7331	111.5673	213.0584	97.85161	92.16283
Log likelihood	466.3961	-4477.798	-5301.180	-1900.771	-2393.921	-1968.566	-4546.292
Akaike AIC	-0.501920	5.263904	6.224116	2.258625	2.833728	2.337687	5.343781
Schwarz SC	-0.387577	5.378247	6.338459	2.372968	2.948071	2.452030	5.458124
Mean dependent	5.313300	11.21180	19.19595	4.613254	7.785574	3.468047	4.639442
S.D. dependent	1.023824	7.700269	10.44889	1.337116	2.280148	1.329894	5.860588

Determinant resid covariance (dof adj.)	17.16364
Determinant resid covariance	14.79502
Log likelihood	-19344.71
Akaike information criterion	22.85331
Schwarz criterion	23.65371

EXOGENOUS VARIABLES: CREDINS, INFMGT, PORTDIV, TECHASS. ROE, PROFIT AND CAPEMGR
ESTIMATES THAT ARE STATISTICALLY SIGNIFICANT.

Source: Research Data 2013

Considering that,

$S(\hat{b}_i)$ - is the standard error

$\hat{b}_i$ -is the estimate

The concentration was on model 2, 3 and 7, with **ROE, PROFIT** and **CAPEMGR** as dependent variables.
The rules:

$S(\hat{b}_i) < \frac{\hat{b}_i}{2}$ Then the estimate is statistically significant thus reject the $H_0 : b_i = 0$

$S(\hat{b}_i) > \frac{\hat{b}_i}{2}$ Then the estimate is not statistically significant thus Accept the $H_0 : b_i = 0$

Table 4.7 shows the output of Vector Auto-Regression (VAR) analysis. The data is based on the quarterly observations made on forty three agribusiness firms for a period of ten years, spanning 2003-2012. This process provides for

regressing each current (un-lagged) variable in the model on the lagged values of the same set of variables in the model. Although each equation in the model has a different dependent or explained variable, all the equations in the system have the same set of regressors [13].Using the standard errors of the lagged estimate coefficient; which can also be confirmed by the corresponding t- statistics, in determining the statistical significance of the coefficients in estimating the changes in the examined variables for the period of ten years, the output reveals that the variables generally yield statistically significant coefficients when lagged; on Profits, Return on Equity and growth on Capital employed.

Model 7 of Table 4.7 provides the **VAR** results for Growth in Capital Employed (CAPEMGR) as the dependent variable and all the others including itself as independent variables. In this model, when capital growth (CAPEMGR) as the dependent variable, the adjusted R-squared is 0.650539; indicating that 65.05% of the variations in the dependent variable are accounted for by the independent variables. The results also indicate that capital growth is affected by its own evolution based on its own lags and the lags of other variables in the model. A unit change in Technical Assistance results (TECHASS) in -0.67 changes in Capital employed growth (CAPEMGR) in lag (-1), -0.6(-2), 0.09(-3), -1.11(-4) and 0.01(-5). All the lagged estimate coefficients of Technical Assistance to Capital employed growth are statistically significant except for lags 3 and 5. A unit change in Return on Equity (ROE) affects Capital employed growth by 0.05(-1), -0.02(-2), -0.02(-3), -0.06(-4) and 0.01(-5); all being statistically insignificant except for lag 1.

Subsequently a unit change in Profit yields the following lagged estimate coefficients on Capital employed growth: 0.05(-1), -0.04(-2), 0.02(-3), 0.06(-4) and 0.04(-5); significant at all the lags except at lag 3. For Portfolio diversification (PORTDIV) results on Capital employed growth are 0.79(-1), -0.52(-2), 0.83(-3), -0.07(-4) and 0.26(-5). They are statistically significant except at lag 4. Information management (INFMGT) on the other hand provides estimate coefficients of, 0.24(-1), -0.28(-2), 0.17(-3), 0.08(-4) and -0.20(-5); which are all significant except for lags 3 and 4. The results of Credit Insurance (CREDINS) were -0.59(-1), 0.43(-2), 0.34(-3), 0.64(-4) and -1.23(-5). They are all statistically significant in all lag levels. Subsequently the results for Growth in Capital Employed (CAMEMGR) on itself reveal -0.69(-1), -0.01(-2), 0.06(-3), 0.26(-4) and 0.16(-5). These are all significant except for lag levels. Therefore all the endogenous variables significantly affect the CAPEMGR. It yields an R^2 of 0.6578, while Adjusted R^2 is 0.6505, which implies that the independent variables account for 65.05% of CAPEMGR over a longer period of time including itself. Subsequently the null hypothesis H_0: r = 0; forward integration credit risk mitigation mechanisms do not significantly contribute to capital employed growth is rejected and the alternative hypothesis H_1: r≠0; is accepted, that is, Forward integration credit risk mitigation mechanisms significantly contribute to capital employed growth of agribusiness enterprises.

5.CONCLUSIONS

The study findings give an R^2 value of 0.531022 adjusted to 0.519438 for Growth in Capital Employed (CAPEMGR) under **OLS** which moves to R^2 of 0.657675 adjusted to 0.650539 in respect of Growth of Capital Employed under VAR. This implies that CAPEMGR of the agribusiness operations is significantly influenced by all the variables under this study including itself; further explaining the exponential estimate of coefficients' contributions for each lag length. It is evident that the role of the Forward integration credit risk mitigation mechanisms to the growth trajectory of the borrower agribusiness firms significantly grows over time R^2= 0.531 to R^2= 0.650. Therefore the inconsistency and low commercial banks credit financing to the sector despite the given positive aggregate growth and its contribution to the national GDP; does not only require financial attention but also modeling a financing channel that recognises the potential of managing FICRMMs to increase productivity potential of the agribusiness sector; in products and employment. Consequently, there is need for sensitivity analysis of the all the component parameters of each mitigation mechanism of Capital Employed growth.

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