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RESEARCH ARTICLE

DETERMINE THE IMPACT OF FORWARD INTEGRATION CREDIT RISK MITIGATION MECHANISMS ON PROFIT OF AGRIBUSINESS IN NYANZA REGION, KENYA

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ABSTRACT

Commercial Banks apply Forward Integration Credit Risk Mitigation Mechanisms (FICRMMs) to promote credit access, security and productivity for various sectors. Credits make a significant portion in business' capital structure and performance; and are notably the main business product for the Commercial Banks. The agribusiness sector contributes 53% employment in developing countries, and over 80% in Kenya, while commercial banks' credits to the sector has registered decreasing trends between 2005 and 2014; ranging from 6.8% to 3.9% of the entire commercial banks credit portfolio. Whereas the agribusiness sector has immense investment potential as credit demand hub, the decreasing investment to the sector requires attention. This paper seeks to determine the effect of the Forward Integration Credit Risk Mitigation Mechanisms (FICRMMs) on profits, return on equity and capital growth of the agribusiness entrepreneurs in the Nyanza region. Using Ordinary Least Square (OLS) Single period Regression analysis, the study results established an R^2 of 0.439 to profit, 0.571 for return on equity, 0.531 to capital growth, implying that FICRMMs account for 44% of profits, 57% of ROE and 53% of capital growth, all significant at $p<0.05$. The lagged VAR results provides R^2 of 0.735 for profit, 0.813 for return on equity and 0.651 for capital growth; all 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 73.5% of profits, 81.3% of ROE and 65.1% of capital growth. Hence $H_{0(1-5)}$: r=0 are rejected and $H_{1(1-5)}$: r≠0 are accepted. In conclusion, FICRMMs are significant for agribusiness performance both at single and lagged period, although credits to the sector are low. It is recommended that sensitivity analysis of the variables be done, establish implementation level of FICRMMs, improve information system, and restructure the mitigation parameters. These results may help in

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INTRODUCTION

George, Geofrey and Leora (2002), state that credits are significant components in the capital structure and business returns; owing to the fact that it gives the business an opportunity for tax relief thereby reducing the taxable profits, as the interest on the debt used in business is often tax deductible. Mhalanga (2010) in an analysis of private sector agribusiness investment in Sub- Saharan Africa posits that commercial banks remain the most appropriate financiers to the agribusiness sector by serving the supply side of credit as the agribusinesses participate on the credit demand side. Joshua, Rauh and Amir (2008) assert that traditional capital structure studies that ignore debt heterogeneity miss a substantial fraction of capital structure variation; hence they fail to distinguish key sectoral requirements.

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Gunther (2010) states that credit risk is historically considered the main risk for banks, which requires an inter-temporal equilibrium model that fully integrates the financial and real sector economic players, in not only understanding the mechanisms at work, but also the specific sectoral credit risk mitigating strategies, for enhanced trade and financial flows. Noah (2005) states that while bankers are quite familiar with the hazards of credit risk, and the related tools and techniques needed to assess and manage it in their portfolios, many are less prepared to deal with the myriad of new loan customer challenges that today's dynamic operating environment brings. Gichira (2010), views agribusiness as a vehicle and innovatively adoptable agricultural practice in Kenya in enhancing agricultural productivity, sustainability and adaptability, through focused investment into small medium and large scale agribusiness enterprises, while Mhalanga, (2010) says that agribusiness is a main source of employment in a majority of developing countries; in which it accounts for

up to 53% employment in developing countries, 60% in South Saharan Africa (SSA), and over 80% plus to the Kenya directly and indirectly. The sector also indirectly contributes approximately 27% of the GDP through linkages with related sectors, 60% of the export earning, and about 45% of government revenue (Republic of Kenya, 2004). Kimathi *et al*, (2008), Agwe and Azeb (2009), Vorley, Fearne, and Ray D. (2006), UNIDO (2012), Geoff and Grahame (2012) and GoK (2012); have all observed in diverse ratings that lack of capital or its stagnation on agribusiness firms renders them incapable of expanding their operation scope, although credit institutions critical interests, are to improve their returns and general performance.

Therefore the role of credits in business' capital structure, their financing benefits, especially in the growth stages of a firm; and the significance of the agribusiness sector which operates in a perceived risk inherent environment, and the position of the commercial banks in provision of credits at costs creates the necessity to analyse effect of Credit Risk Mitigation Mechanisms on agribusiness profits. This is because the sustainability of the sector requires the determination of the productivity of the invested funds, their costs and benefit trade-offs. Tony and Bart (2009), states that commercial banks 'credit risk management is modeled on six key practices; which are, character, capital, collateral, capacity, cost and condition (6Cs), which mainly focus on the borrower based roles. Guo and Wu (2009) explain that the credits process is a triple tier operation (i.e. credit allocation, credit investment and recovery), which requires the consolidation of both the lenders and borrowers relationship; since credit risk management has previously been analysed in a skewed manner in favour of the banks, thereby leaving the borrowers adversely exposed to a heavy two- tier 'risk load'.

Borrowers' business profits provide them with the capacity to repay, while any rumor that a financial institution may not extend additional cash to the borrower who has run out of cash causes the borrower to default, in an effort to protect them against their own pending cash shortage. Abrahams, Clark and Mingyuan (2009) observe that effective credit risk management must draw from both the lenders and the borrowers side parameters, so as to promote credit providers' returns and ensure borrowers' profitability. This puts in to the management framework a balance for controlling default and expanding credit access for investment by the lenders.

Literature Review

The current credit evaluation systems do not take specific agro-industry risk into consideration (David, 2013). The lack of, or limited access to credit, has therefore been a major impediment to the development of primary agriculture as well as the upstream and downstream sectors in all transition economies (Howe, 2003). Available literature on industry-specific credit volumes mainly point to national aggregate of financial, manufacturing and established commercial sectors, with limited focus to agribusiness firm. According to Gabor (2013), the central banks need to embrace their expanded role as "market maker of last resort" ensuring expanded borrowers' potential to turn in sufficient profits as critical indicator of productive credit financing; that subsequently enables them to reduce the probability of default (PD). Commercial banks as agents of this process provide a liquidity backstop for systemically important credit markets, and the shadow banking system that is deeply integrated with these markets to enhance both lenders' and borrowers' profits. Samuel, Dasah and Kwaku (2012) state that Credit risk management is very vital, not only to measure and optimize the profitability of banks, but also for borrowers' profitability. They recognize that the capacity of the borrowers to repay the loans arise from their profits partly generated through credit finance, while Basel (1999) explains that the long term success of any banking institution depended on effective system that ensures repayments of loans by borrowers which is critical in dealing with asymmetric information problems, thus, reduces the level of loan losses.

Borrowers therefore rely upon credits to build their capital base (Malik and Lyn, 2010), which Kimathi (2008) attributes to enhancing business financing, to trigger real business incomes. Drury (2011), states that corporation managers commonly analyse trade-off between inherent risks and expected outcome, rather than the actual returns. The critical role of the borrower business profits in the repayment of the loans, whose grant is a function of the Forward Integration Credit Risk Mitigation Mechanisms, and the fact that growth stage is financed through debt to help realise faster growth, given that credit risk management affects both the borrowers' and lenders' profitability, makes it necessary to determine the effect of credit risk mitigation mechanisms on the performance of agribusiness firms, with respect to profitability, Return on Equity, growth in capital employed.

MATERIALS AND METHODS

Secondary data were gathered through Annual Financial Reports of the agribusinesses. Existing banking reports from Central Bank of Kenya, and other publications from the internet and Government Resource Centers were also be used to gather information on commercial banks' lending to the agribusiness sector.

Reliability Tests

The study carried out a pretest of the instruments among 10 agribusiness firms selected within the region of study and on whom a repeat administration of the instrument was avoided. This helped in clearly defining items of study and homogenising of elements and the duration for which the study was scheduled to cover. This was enhanced by objectivity in scoring, simplifying measurement conditions and clarity of the measurement scale parameters.

Table 3.1.1. Case Processing Summary for Loan Volume parameters

		N	%
Cases	Valid	9	100.0
	Excluded(a)	0	0.0
	Total	10	100.0

a List wise deletion based on all variables in the procedure.

Table 3.1.2. Reliability Statistics for Loan Volume parameters

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.846	.839	15

The General *VAR* Model Description

The model is based on time series data (Mukras, 2012). On the basis of literature, there is sufficient evidence that leads the author to the conclusion that the most appropriate model for the phenomenon under investigation is a vector autoregressive (VAR) model. In a VAR model, 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. This gives rise to a vector autoregressive (VAR) model. One of the four equations in the model, the equation with z_t as the dependent variable, is represented in the following general functional form.

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

Where

$x_t = Portfolio\ Diversification$

$y_t = Information\ Managemnt$

$w_t = Credit\ Insurance$

$u_t = Technical\ Assis\tan ce$

$z_t = Performance$

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

This has been done that in two steps:

Step 1

$$\begin{bmatrix} x_t \\ y_t \\ w_t \\ u_t \\ z_t \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{bmatrix} \begin{bmatrix} x_{t-1} \\ y_{t-1} \\ w_{t-1} \\ u_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} \\ b_{41} & b_{42} & b_{34} & b_{44} & b_{45} \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} \end{bmatrix} \begin{bmatrix} x_{t-2} \\ y_{t-2} \\ w_{t-2} \\ u_{t-2} \\ z_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix} \tag{3.3}$$

$x_t = Portfolio\ Diversification$

$y_t = Information\ Managemnt$

$w_t = Credit\ Insurance$

$u_t = Technical\ Assis\tan ce$

$z_t = Performance$

$\varepsilon_t = Error\ Term$

$$profit = C + \beta(1)credins + \beta(2)\inf mgt + \beta(3)portdiv + \beta(4)techass \tag{5.1}$$

RESULTS AND DISCUSSIONS

Ordinary Least Squares (OLS) Regression

Ordinary least-squares (OLS) regression is a generalized linear modeling technique that may be used to model a single response variable which has been recorded on at least an interval scale. The technique may be applied to single or multiple explanatory variables and also categorical explanatory variables that have been appropriately coded. In order to assess the effect of forward integration credit- risk mitigation mechanisms on the performance of Agribusinesses, the study used three proxy variables to measure performance (dependent variable). These were Profit (PROFIT), Return on equity (ROE), and Capital growth (CAPEMGR). The following four measures i.e. credit insurance (CREDINS), information management (INFMGT), credit portfolio diversification (PORTDIV) and Technical assistance (TECHASS) were used as measures of the forward integration credit risk mitigation mechanisms (i.e. independent variables). In order to measure the effect of the independent variables on each of the respective dependent variables, the study used the OLS method. The main purpose of this was to estimate the relationship and test the hypothesis with respect to those parameters.

The impact of Forward Integration Credit Risk Mitigation Mechanisms on Profit

The study performed OLS regression of profit on Credit Insurance (CREDINS), Credit Information Management (INFMGT), Credit Portfolio Diversification (POTRDIV) and Technical Assistance (TECHAS). The data used in this analysis is based on the quarterly observations of the seven variable for the 43 firms (i.e. 43×4×10 years = 1720 observations). The OLS results on the effect of forward integration credit risk mitigation mechanisms (i.e. credit insurance, information management, portfolio diversification and Technical assistance) on Profit are shown in Table 4.1.

Table 4.1. Forward Integration Credit Risk Mitigation Mechanisms on Profit

Dependent Variable: PROFIT; Method: Least Squares; N=1720
Sample (adjusted): 6 1720
Included observations: 1715 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-4.448761	1.386670	-3.208234	0.0014
C(2)	0.229849	0.201160	1.142619	0.2534
C(3)	1.767139	0.120712	14.63926	0.0000
C(4)	0.635394	0.199864	3.179137	0.0015
C(5)	1.156253	0.261246	4.425909	0.0000
R-squared	0.439799	Mean dependent var		19.18146
Adjusted R-squared	0.428332	S.D. dependent var		10.43752
S.E. of regression	9.170757	Akaike info criterion		7.272820
Sum squared resid	144236.3	Schwarz criterion		7.288663
Log likelihood	-6249.625	Hannan-Quinn criter.		7.278681
F-statistic	127.9227	Durbin-Watson stat		2.001922
Prob(F-statistic)	0.000000			

Note: C(1)= Constant, C(2), C(3), C(4) and C(5) are coefficients of the tested variables; in which case,
PROFIT=C(1)+C(2)*CREDINS+C(3)*INFMGT+C(4)*PORTDIV+C(5)*TECHASS
Source: Research Data 2013

The results in Table 4.21 show that the F-statistics =127.9229 Prob (F-statistic) = 0.000 indicating that the model is significant. This leads the study to adopt the model in 4.1

$$profit = -4.4488 + 0.2298 credins + 1.7671 infmgt + 0.6354 portdiv + 1.5625 techass \quad (4.1)$$

The findings also indicate that the variables information management (*infmgt*), credit portfolio diversification (*portdiv*) and Technical Assistance (*techass*) has each a significant effect on profit. A unit increase in Credit Insurance C(2) increases predicted profit level by 0.2298 percentage points (i.e. 23%) at p> 0.05 significance level. This implies that Credit Insurance does not significantly contribute to agribusiness profits, as shown by the magnitude of the coefficient and the p- value (0.2534). This arises from its cost implication in operating environments and the fact that Insurance cost are direct credit cost deductible from the loan granted before the credit amount gets to the business for application to functional business operations that generate incomes.

This result confirms Jain and Parshad (2009) view that credit insurance guarantees projected return cover to the lenders, thereby helping in offsetting the credit liability to a significant extent from the borrowers' default. It is therefore lender oriented than borrower focused. For Mohamed *et al*, (2011) credit insurance is an additional cost to the agribusiness borrowers, and does not contribute directly to the operational returns of a firm. A one percentage increase in information management C (3) increases predicted profit levels by 1.767 percentage points (i.e. 177%) at p< 0.05 significance level. This implies that Credit Information Management's contribution to agribusiness profit is quantitatively high and significant. This variable should critically be natured and its parameters be explored with intention of strategically employing them to promote agribusiness' borrowers credit access and profitability; which subsequently improves borrowers' capacity and help reduce Probability of Default (PD).

This result are in agreement with Mwanamambo *et al* (2007), who states that investments in agribusinesses is enhanced through structured information management, which enables the sector to attract credit share to capital and promote agribusiness productivity and economic growth. Miller (2008), also states that strategic alliances, Value chain financing innovation and improved information structure and policies would be the mainstay of the agribusiness sector. A unit increase in Credit portfolio Diversification C (4) results into increase of predicted profit levels by 0.6354 percentage points (i.e. 63.54%) at p< 0.05. this implies that Credit Portfolio Diversification significantly contributes to agribusiness profits. This result is critically important in redesigning the credit product features relevant to the unique requirements of the agribusiness sector. According to Nieuwerburgh (2009) portfolio diversification defines performance and sector risk orientation, while Grundke (2008) suggests that credit portfolio integration with other risk types delimit credit demand.

A unit increase in Technical Assistance C (5) increases the predicted profit levels by 1.5625 percentage points (i.e. 156%) at p< 0.05. This implies that Technical Assistance significantly contributes to agribusiness profits. The commercial banks must therefore invest in the provision of technical assistance based programmes so as to improve informed application of credit funds and determine capital sufficiency to the agribusiness sector. These functions will therefore promote agribusiness profitability and productivity; while at the same time reduces the probability of default (PD). According to Goshim (2010), Technical Assistance strengthens the company's business systems and operations to enable it to reach its growth potential.

Since the objective of the study is not forecasting but estimation of contribution of the forward integration credit risk mitigation mechanisms on agribusiness profits, the value of R-squared is not very vital in this study. However, the R-squared value of 0.4398 adjusted to 0.4283 implies that the analysed FICRMMs aggregately only explains up to 42.83% of profit variations over the period. Narrowing the output to "R-squared" and "S.E. of regression," this regression accounts for approximately 44 percent of the variance in the dependent variable and the estimated standard deviation of the error term is 1.17. R^2 measures what fraction of the variation in the left hand side variable is explained by the regression. When you add another right hand side variable to a regression, R^2 always rises. This is a numerical property of least squares. These results mean that the data movement fairly predicts or only accounts for 42.83% of profit variation. However Credit Insurance is not significant contributor to the profit whereas it is an important mitigation tool that cannot be removed from the credit risk mitigation model.

The p-value testing the Null hypothesis H_0: r = 0 reveals that p< 0.05. Therefore the Null hypothesis, H_{03}: r = 0; that Forward Integration Credit Risk Mitigation Mechanisms do not affect profit of agribusiness enterprises in Nyanza region is rejected and alternative hypothesis H_{13}: r≠0; Forward Integration Credit Risk Mitigation Mechanisms affect profit of agribusiness enterprises in Nyanza region is accepted. As a result, changes in the predictor's value are related to changes in the response variable. Based on a general rule of thumb, the residuals of the predictors are uncorrelated, as the Durbin-Watson statistic is approximately 2 (i.e. 2.001922). This means the size of the residual for one mitigant has no impact on the size of the residual for the next mitigant. The two progressive sets of statistics therefore reveal that whereas FICRMMs play an important role in determining the agribusiness profits in the Nyanza region, they only account for up to 42.83% of the changes or variations in profits, when they are exclusively regressed on agribusiness profits for a single period. Further, when the other explained (dependent variables) are infused into the model, for a longer period taking into account the selected lag lengths, the factors increasingly upscale their aggregate account on the variability of profits to 82.21%. This further explains that agribusiness profit is a function of all the variables 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.

These results concur with Bedendo (2012) in terms improving information systems, strengthening rural financial sector, agricultural insurance management, market based price management, credit safety netting and income planning as the mitigation mechanisms or instruments which affect agribusiness profits. However this study reveals that Credit

Insurance does not affect agribusiness borrowers' profits. Information Management and Technical Assistance together with Credit Portfolio Diversification are the key contributors to agribusiness profits. There is therefore the need to invest more resources on providing or implementing these mitigants so as to improve agribusiness profits. Therefore the Forward Integration Credit Risk Mitigation Mechanisms' (FICRMMs) contribution to agribusiness profits by 42.83% in the region reveals that 57.17% of profit is accounted for by other factors outside the scope of this study including the insignificant contribution of Credit Insurance; without whose effect the coefficient magnitude would be higher. This implies that credit insurance parameters' setting is still skewed in favour of the lenders than borrowers. Although considered as component to FICRMMs, its forward integration contribution is insignificant, which may necessitate its exclusion from the model or a critical redesign of its parameters to sensitively focus credit demand expansion and implied profits.

Further diagnostic tests of the variables

In order to ensure that estimated parameters and model is valid and reliable, the study tested for the assumptions of OLS i.e. linear in Parameters, random sample of *n* observations, zero conditional mean, no perfect collinearity and homoskedasticity. The results are shown in Table 4.22 and Figure 4.3.

Table 4.2. Serial correlation and Heteroskedasticity test for Profit Model

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1731.215	Prob. F(2,1713)	0.0000
Obs*R-squared	1150.702	Prob. Chi-Square(2)	0.0000
Heteroskedasticity Test: White			
F-statistic	1.371653	Prob. F(14,1705)	0.0000
Obs*R-squared	18.67373	Prob. Chi-Square(14)	0.0000
Scaled explained SS	62.07605	Prob. Chi-Square(14)	0.0000

Source: Research Data 2013

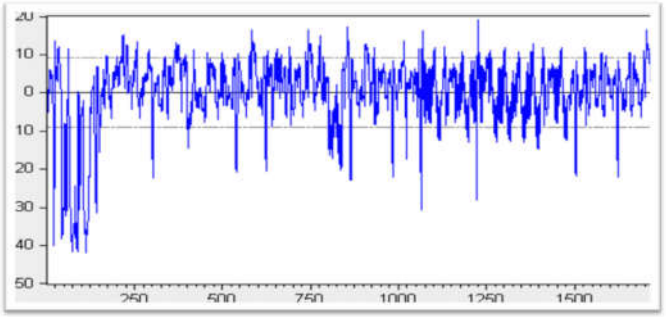
The tests for autocorrelation and heteroskedasticity in Table 4.22 indicate the absence of the problems of econometrics thus there is no serial correlation and heteroskedasticity in the residuals of the model. The results in Table 4.23 indicate that multicollinearity does not exist among the dependent variables. Being a statistical measure of how elements are identically distributed around every Independent Variable in terms of the assumption of parametric analyses (e.g. linear regression), it specifically assumes that the error (residual) of a regression model is homoskedastic across all values of the predicted value of the Dependent Variables i.e. determining whether a regression model's ability to predict a Dependent Variable is consistent across all values of that Dependent Variable (Independent Variables or Dependent Variables need not be normally distributed, as long as the residuals of the regression model are normally distributed). There is therefore no serial correlation as shown by the F-statistics (1731.215) and the observed R-squared (1150.702) Table 4.23 shows multicollinearity test results. Because multicollinearity misleadingly inflates the standard error (SE), thereby making some variables insignificant, VIF is used to tell how much the variable of the estimated coefficients are increased over the case of no correlation among the independent variables (how larger the SE of a slope has grown because of the presence of collinearity).

Table 4.3. Multicollinearity test for Profit Model

Variance Inflation Factors (VIF)			
Variable	Coefficient Variance	Un-centered VIF	Centered VIF
C(1)	1.922853	39.32458	NA
C(2)	0.040465	11.39719	1.461270
C(3)	0.014571	19.59746	1.544719
C(4)	0.039946	18.88001	1.461929
C(5)	0.068250	40.89384	1.460264

Source: Research Data 2013

Being a reciprocal of tolerance VIF shows how much the variance of the coefficient estimate is being inflated by multicollinearity. If VIF of one of the variables is VIF around or = 5, then there is collinearity associated with the variable. Various recommendations for acceptable levels of VIF have been published in the literature. However, a recommended maximum VIF value of 5 (Rogerson, 2001) and at times 4 (Pan and Jackson, 2008), can be found in literature. Therefore while it would appear that researchers can use whichever criterion they wish to help serve their own purposes, 5 has been chosen for this case. Consequently the variables have acceptable moderate correlation at 1.46127, 1.54472, 1.46193 and 1.460264; implying that VIF < 5.



Source: Research Data 2013

Figure 4.1 Residuals for Profit

Figure 4.3 shows that the residuals of the model are normally distributed. This is because the dependent variable tends to evolve around the mean. The residual observations reveal that extent of sensitivity of the agribusiness profits to the general operation environment factors in addition to the considered FICRMMs. The conspicuous losses reflected by the first set of observations depict that the fewer the observations, the more unstable the outcomes.

This then tends to be more stable with increased observations over a longer period of time. Figure 4.6 shows a plot of the recursive residuals of quarterly profit index of the agribusiness firms from 2003 to 2012 for the 1720 observations on the 43 sampled firms. The dependent variable is the quarterly computed profits. The majority observations are within 10% points range ($-10 \leq t \geq 10$) as compared to those points where the recursive residuals go outside the two bounds thereby confirming that the residuals of the model are normally distributed. Therefore, the variables are normally distributed since they devolve around the mean or zero line over the period. However the observations outside this range account for the vulnerability of the profit determinants over the study time period.

Conclusion

The third objective of the study was to determine the impact of Forward integration credit risk mitigation mechanisms on profit of agribusiness.

$$profit = -4.4488 + 0.2298 credins + 1.7671 \inf mgt + 0.6354 portdiv + 1.5625 techass \quad (5.1)$$

The findings also indicate that the variables information management (*infmgt*), credit portfolio diversification (*portdiv*) and Technical assistance (*techass*) have a significant effect on profit. A unit change in information management leads to 1.767139 change in profit with ($p = 0.0000 < 0.05$). A unit change in portfolio diversification leads to 0.635394 changes in profit with ($p = 0.0015 < 0.05$), and lastly, a unit change in Technical assistance leads to 1.156253 changes in profit with ($p = 0.000 < 0.05$). On the other hand, credit insurance (*credins*) does not have a significant effect on the profit.

However, the positive coefficient implies that although the variable does not highly contribute to profit, increased employment of credit insurance yields positive but insignificant results on profits ($p = 0.253 > 0.05$). Since the objective of the study is not forecasting but estimation of contribution of the forward integration credit risk mitigation mechanisms on agribusiness profits, the value of R-squared is not vital in this study. However, the R-squared value of 0.439799 adjusted to 0.428332 implies that the analysed FICRMMs aggregately only explains up to 42.8332% of profit variations over the period. The regression results of the Forward Integration Credit Risk Mitigation Mechanisms on profit give a coefficient of determination value (R^2) of 0. 439799, adjusted to 0.428332. This implies that when regressed on a distinct variables category to profits, 42.8332% of the observed profit variability can be explained by the FICRMMs analysed. Further, when the other explained (dependent variables) are infused into the model, for the same period and the same lag lengths, the factors increasingly upscale their aggregate account on the variability of profits to 82.21%. This further explains that agribusiness profit is a function of all the variables including itself. This can be seen reflected in the VAR model and VAR model substituted coefficients (equations 4.6.1 and 4.6.2) which explain the exponential estimate of coefficients' contributions for each lag length.

Further Diagnostics

There is no serial correlation and heteroskedasticity in the residuals of the model. The results further indicate that multicollinearity does not exist among the dependent variables. The majority observations are within 10% points range ($-10 \leq t \geq 10$) as compared to those points where the recursive residuals go outside the two bounds thereby confirming that the residuals of the model are normally distributed.

Therefore

It has been established, through this study, that Forward Integration Credit Risk Mitigation Mechanisms (FICRMMs) play an important role in determining the agribusiness profits in Nyanza region. The variables however, account for up to 42.83% of the changes or variations in profits for a single time period, with a $p = 0.000 < 0.050$; when the variables are exclusively analysed for a single time period. Further analysis of the variables in a Vector Auto- Regression model, lagged 5 times, revealed increased effect of their aggregate account on the variability of profits to R^2 of 0.7349, implying that the independent variables account for 73.49% of the variations in profit, over the ten years period when the evolving variables were observed on a quarterly basis. This implies that agribusiness profit is a function of all the variables including itself, under a VAR model. The high coefficient of determination of profit (0.7349), and the related significance levels of the lagged coefficients of profit and other variables on itself depicts Forward integration credit risk mitigation mechanisms as significant determinants of agribusiness profit with $p = 0.000 < 0.050$. The coefficient of determination values increase with time from; $R^2 = 0.428$ to $R^2 = 0.7349$. The Forward integration credit risk mitigation mechanisms should be strategically and consistently implemented to expand real credit demand in the agribusiness sector, while the negative shocks shown by some lagged coefficients or effects be monitored and mitigated to ensure increased credit security for the sector.

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