EXTRANEOUS SHOCKS AFFECTING AGRIBUSINESS LOANS DEFAULT RATEINAGRICULTURAL FINANCE CORPORATION, MOUNT KENYA REGION

ABSTRACT

Agro-shocks create stochastic disturbances to agribusiness performance, which spills over to the performance of credit markets. Farm loan beneficiaries domiciled in the Mount Kenya Region of the Agricultural Finance Corporation (AFC), have recorded a poor loan repayment rate of 20.33% versus 10%, which is the Central Bank of Kenya benchmark for all types of loans in Kenya. Given that agribusiness is a priority sector for addressing food and employment concerns, the performance of agri-loans is sacrosanct. This study aimed to determinetheeffectofextraneousshocksonthedefaultrateof agribusiness loans disbursed by AFC in the Mount Kenya Region.The region has11 branches with a population of 3,002 agribusiness borrowers. A sample of 300 respondents was drawn using systematic random sampling with an interval of ten. In a descriptive design using a structured questionnaire, primarydata were collected on the effect of extraneous shocks on the default rate of AFC loans. To analyse thedata, theStatistical Package for Social Sciences (SPSS V.27) was used. The effect of variables in predicting thedefault rate was estimated using regression analysis. To derive the F-statistic to test the adequacy of the regression model, ANOVA was performed. A multipleregressionmodel was used to determine the statistical relationship between extraneous shocks and AFC loan default. The model estimates revealed that the three indicators (agroclimatic extremes, market volatility and biological hazards) of extraneous shocks explained 23.90% of theAFC loan default rate. The findings revealed that the statistical significance of the extraneous shocks was positive and significant at 5% (p values=0.00<0.05), implying that their occurrencespresented performance challenges to the funded farming projects, thus plunging the loan beneficiaries into repayment challenges.Thelevel of association of each of the indicators with the default rate is as follows:agroclimatic extremes (21.7%), market volatility (30.6%) and biological hazards (17.3%). This studycontributes to the existing body of facts in agricultural finance and risk management by bringing to the fore that agro-shocks are sources of far-reaching menaces that constrain the sustainable production process further hindering the repayment of agricultural loans.The study recommends the need for strategic imperatives pointing to interventionist policies through protectionism, partnershipsand themitigation strategies to internalize the resultant negative externalities;loan actors should provide for contingencies and be alert to absorb risks emanating from shocks; penultimately, credit players should collaborate in pursuit of bespoke insurance schemes that can suitably cover farmer projects; ultimately, credit stakeholders should adopt coping strategies to cushion the societies from emerging distresses and devastating constraints.

Keywords:AFC loan;default rate; borrower: extraneous shocks: repayment.

1. INTRODUCTION

Extraneous shocks trigger stress in one dimension and spread it into another dimension, thus making them an important aspect of the farming business [1]. Extraneous shocks are unpredictable, originate from outside the operations of the phenomenon and have an impactthat is significant and visible [2]. The impacts of

extreme events create stochastic perturbations that disturb agribusiness performance, which spills over to the performance of credit markets [3]. Loan guarantees should be extended to cushion borrowers from defaulting if their investments are climatefriendly [4]. However, banks do not reduce credit flows indiscriminately because they shield their core markets strategically [5]. Shocks present decision makers with limited information and knowledge regarding the occurrence of outcomes linked to a certain course of action [6].

InMount Kenya region, agribusiness improves sustainable management by influencing the livelihood-related drivers of food security [7]. Agribusiness meets the demand for growing population and tastes [8].Agri-based enterprises have broughtprofound changes to farming communities, the farming way of life and the environment by embracing smart modern farming practices which have increased efficiency [9]. The agribusiness sector has a snowball effect on socio-economic aspects in terms of generating revenue, creating jobs, foreign exchange earner, food security and poverty alleviation [10]. Besides, it forms a critical component in industrial fabric owing to its multifunctional nature [11].

Currently agriculture and food systems are highly strained due to climate change: extremities in weather, amplified water shortage, severe rainfall, tinkered temperature patterns and the intensifying pest pressure[12]. The climate impact on agriculture directly distorts price, quantity and quality of products[13].The resultant brunt from agroclimatic immoderations cascades to financial institutions, presenting negative impacts to credit markets that are linked to loan default[14]. Generally, the forecast of agri-finance establishments is thatclimate change eventualities would negatively impacts the financial circumstances of the clients as depicted in high default and correspondingly high exit rate[15].Extraneous shocks are closely tethered to a myriad of risks which confront farmers and present themselves unexpectedly and haphazardly [16]. Among the resultant risks, financial risks are the most persistent and climacteric having devastating impacts to the farming business and eventual underperformance of loans [17]. Effective financial risk management is therefore the magic bullet to sustainable growth of agricultural enterprises and positive growth of agricultural finance markets[18].Elaborately, agro-risk mitigation is mutually connected to reduced instances of farm loan default rate [19]

The effects of extraneous shocks are risk outcomes such as adecline in agricultural productivity and poor performance in credit markets [20].Risk management knowledge may equip borrowers with theskills to overcome revenue loss [21]. Risks posed by extraneous shocks impede the provision of credit, and where it is extended, there is potential for much higher default rates among agricultural clients [22]. Production risks emanate from bad weather, and they influence the ensuing price spikes [23]. Farmers also experience institutional risk, which is tied to unforeseen changes in government policy [24]. Risks cause spillover effects by producing different risky outcomes [25].For example, flooding may engender financial and human risks, which makes it difficult to realize the projected yield [26]. This makes it difficult to raise money for loan repayment, thus making compliance in loan repayment a mirage [27].Risk implies that farm decisions are met with uncertainty about the occurrence of an event that causes unpredictability in thefarming business [28].Extraneous shocks cause transition risks, which occur as costs to enterprises due to unforeseen climatic events[29]. Ultimately, loan default arises because it is a risk

eventuality that borrowing farmers have not anticipated [30].

Past studies have linked extraneous shocks to agribusiness loan defaults. Kanwal[31] observed that there was ahigh perception of bad weather; flooding areas compelled households to proactively engage in control measures and monitor risks to reduce loan defaults. Hess [32] reported that agricultural enterprises were integrally knotted on unpredictable circumstances; hence, constraints and uncertainties pointing to low yield risk. TheimpactsofCOVID-19 and floods caused adisbursement lag, decreased the value of loans accessed by farmers, andincreased cost and effort during loan recovery, thus increasing default in loans. Kibrom[33] agreedthat market problems such as market unpredictability, price volatility and insufficient marketing channels are the main causes of default in agribusiness credit. These studies exhibit methodological, conceptual and contextual gaps. To address these gaps, this study analysed variables from a broader perspective by studying a whole region, adopting more indicators and increasing the sample size.

Shocks induce risks in terms of production, pricing, andfinancing and to institutions and humans[34].Shocks includepricedisparitiesand fluctuations [35]; bad weatherchallengessuch as drought, flooding, strong winds and depressed rainfall [36]; variability in soil quality Suppan [37]; and natural hazards such as pest and disease infestations, flooding, fire disasters, thunder and lightning. They are also indicated forweather, pests, floods,and disease orprice variability, and they reduce farm production income, thus making loan repayment difficult [38].This study adopted three indicators that extraneously affected default in AFC agribusiness loans. These include agroclimatic extremes, market volatility and biological hazards. The objective of this study is todeterminetheeffectofextraneousshocksontheAFCloandefaultrate.The impact of extraneous shockson agribusiness projects thus contributes tremendously to the problem of default, which hinders thesustainable recycling of farm loans; if unchecked, the trend would make the future of credit markets bleak since agribusiness investors would be risk averse, thus declining to borrow and use loans in farming.

Agroclimatic extremes are indicated by drought, which is the main element [39]. This is because drought is a template for how climate change-induced water shortages could impact farming communities in the future [31].Even if farmers rely on irrigated agriculture, drought brings great water shortages since the available amount of water is prioritized for urban centres ratherthan for agriculture [29]. Agricultural production is intrinsically hooked on weather uncertainties, especially in relation torain fluctuations[40]. Bad weather events cause enormous damage to the economy and risk to the lender if loans are not secured[41]. Extreme climatic anomalies exert biophysical stress and are a source of yield fluctuations in harvest-failure scenarios, thus indicating yield stress [42].

Market volatility is caused by inelastic responses to market gestures, infrastructuredeficiencies, the risk of production due to the vagaries of agroclimatic circumstances and the onset of disease[43].Consequently, volatility may not stabilize prices, thus causing thedelivery of low volumes of produce and constraining producers' strategies for participating in the marketplace [44].Market volatility increases the cost of borrowed capital because the prices are distorted, resulting in financial losses and wasted labour[45].Agricultural markets are characterized by

volatile market dynamics [46].Any sudden market change alters commodity prices due to shortages or surpluses; this depresses the borrower's revenue, hence resulting in loan default [47].

Biological threats (epidemics, infection by insects and accidents with animals) result from exposure to living organisms and their corresponding toxic substances (venom or mould) or from diseases transmitted by vectors [24].Infiltration of the environment by pests and diseases affects credit markets by limiting access to agricultural loans and credit [48]. This also hampers the performance of loans that are already being repaid [49]. Therefore, they are not considered provisions during preparation for project undertaking [50].COVID-19 caused yield stress and unprecedented disbursement delays, which increased the cost and effort during loan recovery, thus increasing default in loans [51].The recent occurrence of biohazards in Kenya changed the food security situation and agricultural livelihoods, which resulted in chaos and disruption, culminating in a credit crisis [52].

This study purposed to determinetheeffectofextraneousshocksonthedefaultrateof agribusiness loans disbursed by AFC in the Mount Kenya Region. Extant studies on default and extraneous shocks havenot been conclusive and exhaustive due to conceptual,contextual and methodological gaps and as such failing to link extraneous shocks to agribusiness loans default rate; the scope of studies on biological hazards has been minimal owing to the fact that the phenomenon is recent and limited experiences have been documented. Extraneous shocks being a great and unpredictable force hindering sustainability in production performance and the resultant loan servicing, it is imperative to dissect the effects with a view to fixing the constraints.Default leads to systemfailure to implement appropriate lending strategies, credible credit policies and threatens the institutional sustainability.If the current state of default continues unabated, there is a likelihood of credit rationing, protracted poverty levels and shutdown of agri-financing. This study thereforeextemporized a suitable and comprehensive methodology which adequately reported the gaps.

2. METHODOLOGY

2.1 StudyArea

The study was conducted between June 2022 and December 2022 in theMount Kenya region, which is oneof the six AFC regions. This region was selected due to a variety of agribusiness projects and the highest number of branch network, thus, one of the AFCcatchment areas. This region was selected through convenience sampling because of itscomparativelygood branch network, variety of agribusiness activities and agroclimatic zones, which formed adequate and comprehensive basis for the study. The GPS coordinates of this region are 36.561, 2.168 and 37. 852, -0.85 [53]. The branch network of this region comprises 11 branches, which include Meru, Chogoria, Embu, Kerugoya, Thika, Murang'a, Nyahururu, Maralal, Nanyuki, Nyeri and Karatina. These branches are spread across 9 counties, namely, Meru, Tharaka-Nithi, Embu, Kirinyaga,Kiambu,Murang'a,Samburu,LaikipiaandNyeri.

2.2 ResearchDesign

The study used adescriptive research design. The aim of this design is to systematically obtain information to be in a position of phenomenon description or todescribe a situation or population [54]. The design utilizesa myriadofresearchmethodsto explore the variables inquestionbychieflyemploying

quantitative data for descriptive purposes, collection and analysis of numerical data [55]. This design was accurate and systematic in collecting and describing extraneous shocks in the region ofMount Kenya, the default problem and the determinants of default. The rationale for choosing the aforestated extraneous shocks was informed by their relevance in causing immediate and direct disturbances in agribusiness production and the eventual repayment of the loans invested in farming.The choice of this design was guided by the possibility of using diversemethods of research to examine, observe and measure variables that concern default in agribusiness loans in AFC. This design was adopted by Chege [15] in examining practices of managing loans and credit nonrepayment in AFC, Kenya. In addition, Adusei [56] adopted this design to study the determinants of loan default in agribusiness entities inGhana. Mwirigi [57] used adescriptive research design to study themanaging relationships of customers and the satisfaction of account holders of commercial banks in Nairobi County, Kenya.

2.3 Population, SamplingProcedures and Sample Size Determination

2.3.1 Study Population

The population of study was farmers who borrowed agribusiness loans from the 11 branches of theMount Kenya region for the period of 2018–2022. All agribusiness loans disbursed by theAFC are serviced in 36 months. These borrowers comprise all current beneficiaries withoutregardtotheirloanlevelandrepaymentperformance.TheAgriculturalFinance Corporationbranchreports of 2022 showtheperformanceofborrowerswhoareservicing3-yearagribusiness loanstotalling3,002 (Table1).

Table 1: Distribution of Borrowers, Respondents and Defaults in Mount Kenya Branches

Branch	County	AgribusinessBorrowers	Distribution of respondents	Averagedefaultrate for 5 years (%)
Meru	Meru	401	40	22.82
Chogoria	Tharaka-Nithi	217	22	24.96
Embu	Embu	211	21	22.86
Kerugoya	Kirinyaga	251	25	23.91
Thika	Kiambu	311	31	25.61
Muranga	Muranga	301	30	21.98
Nanyuki	Laikipia	241	24	25.75
Nyahururu	Laikipia	271	27	24.87
Maralal	Samburu	196	20	26.12
Nyeri	Nyeri	341	34	24.58
Karatina	Nyeri	261	26	24.39
Totals/percent		3,002	300	24.15%

Source: AFCAnnualReports (2022)

2.3.2 Samplingprocedures

The population included 3,002 borrowers from which sampling was designed to identify the default cases and nondefault cases (controls). Default was for all those with loans whose repayments were not regularized regardless of thecause of noncompliance. The controls were selected based on theabsence of ahistory of

nonconformity. According to the AFC records for the close of financial year 2022, there were 3,002 agribusiness borrowers in theMount Kenya region.Using asystematic random sampling method with a 'skip' of ten, a sample of 300 borrowers was retrieved and reviewed (Table 1).

The interval was used to avoid clustered selection, thus ensuring that respondents were spread across the branches under study. By "skipping" at intervals of 10, overconcentration in one branch was eliminated; thus,afair distribution guaranteed representativeness. With this interval, the count loops fromanypoint to finish the count that is needed. In addition, the interval guarantees that the sample is drawn from both defaulters and non-defaulters[58]. To conductsampling, anelement wasrandomly selectedfromthe list, and then everyk^{th}element in the frame was selected. This was calculated as follows: k=N/n**,** where*k* is the sampling interval (sometimes known as the skip), *n* is the sample size, and *N* is the populationsize. Inourcase, the sampling intervalwas determined ask= 3,002/300 = 10. This means that the respondents were selected fromtheAFC list at random after skipping ten.

2.3.3 SampleSizeDetermination

It was important to select a sample to represent apopulation from a relatively similar population. Stratification aims to reduce the standard error by providing some control over variance. To calculate the size of the sample,theDaniel [59] formula was used as follows:

$$n = \frac{Z^2 P (1-P)}{d^2}$$

where
n = sample size,
Z = Z statistic for a level of confidence,
P = expected default or proportion (in proportion of one; if 20%, P = 0.2), and
d = precision (in proportion of one; if 5%, d = 0.05).

Zstatistic(Z):Atthe95% confidencelevel,whichisthe standard level, theZvalueis 1.96.Inthesestudies,investigatorspresenttheirresultswith95%confidence intervals(CIs).

Using 1.96 as the standard deviation for the95% confidenceinterval, with aknown sample size and a known proportion, theprecision can be determined. To calculate the margin of error, the nonnegative square root is considered [60].In our case, there were 3,002 agribusiness loan beneficiaries. Defaulters represented 24.15% of the total beneficiaries.For the sample size, the following calculation was performed:

$$n = \frac{1.96^2 \times 0.2415(1-0.2415)}{(0.04843)^2} = \frac{0.7036956444}{0.0023454649} = 300$$

Z=confidencelevel =1.96
P=Default=0.2415
d=precision=0.04843
n=300
The distribution of 300 respondents per branch is indicated in Table 1.

$$n = \frac{Z^2 P (1-P)}{}$$

d^2

where

n = sample size; Z = Z statistic for a level of confidence; P = expected default or proportion (in proportion of one; if 20%, P = 0.2), and d = precision (in proportion of one; if 5%, d = 0.05).At aconfidence levelof 95%,the Zvalueis 1.96.To establish the sample size, the calculation was performed given that thedefault was 24.15:

$$n = \frac{1.96^2 \times 0.2415(1-0.2415)}{(0.04843)^2} = \frac{0.7036956444}{0.0023454649} = 300$$

Z=confidencelevel =1.96; *P*=Default=0.2415; *d* = precision=0.04843; *n*=300

2.4 PilotStudy

The pilot study was conducted in theCentral Rift region, where respondents were drawn from 4 branches, namely, Nakuru, Naivasha, Molo and Kericho, using 30 respondents who were agribusiness borrowers. The distribution of respondents was as per customer size such that 9 were drawn from Nakuru, 8 from Kericho, 7 from Naivasha and 6 from Molo.TheCentral Rift is more similar to Mount Kenya due to its weather conditions and diversity of agribusiness projects. The pilot study helped to identify whether thequestionnaires were ambiguous, unclear or biased to determine the necessaryadjustments that couldbe made to thedata collection instruments. It was used to determine the feasibilityofresearchdesign, formingapreliminary, small-scale "rehearsal" in whichtotestthe methodsplanned for use in the research project [61]. The results were used to guide the methodology of the large-scale investigation. The recommended overall sample size is 30 for the pilot study, especially when the pilot study sample is 10% of the sample projected for the larger parent study [62].

2.5 Validity

The studyemployeda questionnaire thatwas tailored keenlyand thoroughlyto ensure that allrelevant material facts were captured. This was to ensure theaccuracyand accommodation of allpertinentdetails.Thestructuredquestionnairewaspilottestedin theCentral Rift Regionat theNakuru, Kericho, Molo and Naivasha branches.Thisestablisheditsrelevancetothestudyo f producing accurate results.Construct validitywas achieved throughthe operationalization of the variables, which reflected the theoretical assumptions that supported the conceptual framework of the study [63]. Content validity was assessed by testing the data sheet in the main areas of the study. Statistical conclusion validity was attained by determining various relationships and the cause–effect of variables, especially due to themoderation of extraneous shocks. The criterion-related validity of the conceptual framework was determined by examining the multiple correlation coefficients of all the independent variables and the dependent variable [64].

2.6 Reliability

The reliability of the research instrument (questionnaire) was evaluated using Cronbach's alpha coefficient. The questionnaire was evaluated by estimating the internal consistency of theresponses to examine the reliability of thescales. Cronbach's alpha is appropriate for dichotomous variables coded as 0 or 1 [65].Zero means that there is no internal consistency between items in the questionnaire, while

one means that theinternal consistency is perfect [66]. A higher value of greater than 0.9 indicates excellent quality, while a lower Cronbach's alpha of less than 0.5 indicates unacceptable quality [67].The results of this study indicated that the questionnaire was reliable since the scale reliability coefficient was 0.7318(>0.7), which is acceptable. This is because the Cronbach's alpha values for different dimensions of the present study are greater than 0.7, meaning thatthe data are considered sufficiently reliable and consistent (Table 2).

Table 2: Reliability Test Using Cronbach's Alpha

Variable	Value
Average interim covariance	2.365
Number of items in the scale	15
Scale reliability coefficient	0.7318

George [68]suggested that the scale reliability coefficient of any research instrument should be greater than 0.7 for it to be deemed acceptable and reliable. This observation was supported by Hair [69], who agreed that a value of more than 0.7 for Cronbach's alpha indicates that thecollected data were sufficiently reliable and consistent.

2.7 DataCollection

This study used both primary and secondary data as sources of information. All questions from the five sections of the questionnaire were used to collect quantitative data where borrowers provided answers regarding their socioeconomic profile, their decision making about enterprises, their lender behavioural characteristics and the extraneous shocks that caught up with themas the project cycle progressed. Primarydata were obtained from the respondents who were current beneficiaries of AFC farm loans. The secondary data were sourced from AFC and published works from relevant authorities, such as articles, journals, magazines, AFC manuals and reports, published financial statements and the internet. The 300 selected farmers were telephoned to inform and request that they suggest how they could be reachedforinterviews.Allrespondentswereguidedonhowtoanswerquestionsby enumerators. The secondary data that were collected included data on theperformance of branches, type of loan products, administrative units and agribusiness activities.

2.8 DataAnalysis

2.8.1 Dataanalysis techniques and tools

The software usedfor analysis was the Statistical Package for Social Sciences (SPSS V. 27.0).The quantitative data were analysed via descriptive statistics and regression analysis. Regression analysis was used to describe the relationship between theindependent and dependent variables. The econometric models that were used included logit, binary logistic regression, probit and multiple linear and stepwise regression models. Each of the objectives was regressed using its own model. Correlation analysis was used to evaluate the strength of the relationships between the variables. This is because correlation analysis illustrates both the direction and the strength of the relationship between the two variables [70]. ANOVA was performed to obtain the F-statistic to test for the adequacy of the regression model.

2.8.2 ModelSpecification

2.8.2.1Determiningtheeffectofextraneousshocksontheafcloandefaultrate

Multiple regression models are appropriate for achieving this objective. The regression equations were formulated as follows:

$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\varepsilon$…….. (i)

where the probability of defaulting or complying with loan repayment is influenced by extraneous shocks. Y= AFC default rate;β_0 = constant$\beta_1-\beta_3$= regression coefficients;ε= errorterm; X_1=agroclimatic extremes; X_2=market volatility; and X_3= biological hazards.

3.RESULTS AND DISCUSSION

3.1Effect of Extraneous Shocks on theAFC Loan Default Rate

3.1.1 Agroclimatic Extremes

The loan repayment distribution on the basis of agroclimatic data implies that 31.7% of borrowers experienced favourable conditions, while 68.3% were victims of bad weather. This means that themajority of borrowers in the area of study experienced more severe weather than didtheir minority counterparts who were not affected by harsh weather conditions. Furthermore, the repayment performance data indicate that 54% of thedefault rate was registered due to extreme weather. There was high loan repayment performance in favour of borrowers who were not affected by bad weather andwho registered a paltry with an8% default rate (Table 3).

Table 3: Loan repayment status and distribution based on agroclimatic extremes

Agroclimatic extremes	Loan status		Borrowers' distribution
	Compliance	Default	
Favourable climatic conditions	88 (92%)	7 (8%)	95 (31.7%)
Unfavourable conditions	151 (74%)	54 (26%)	205 (68.3%)
Total/Percent	239 (79.7%)	61 (20.3%)	300 (100%)

Pearson chi-square =14.4260; df=1; Pvalue = 0.000<0.05

The findings of this study established that there was a significant association between agroclimatic extremes and loan repayment performance at the5% level (P value = 0.000<0.05). The implication is that shocks associated with agroclimatic extremes influence the loan repayment performance of AFC borrowers.The findings agree with those of Komarek [34], who reported that agroclimatic extremes contribute to multiple risks that hamper production, marketing and financial availability, thus increasing the probability of default in agribusiness loans. Emphatically, bad weather exacerbates default problems among farming communities. This is likely due to yield stress caused by crop failure.

Kibrom[33] was also in concurrence, thus reporting that adverse weather conditions represented significant risks for agricultural sectors and geographic regions, with the attendantchallenges causing default in loans disbursed for project execution [20].This was attributable to the fact that the occurrence is an unforeseen event, which necessitates thepossibility of adjusting to absorb more costs to avoid project collapse. Production and market risks result in financial risk, which is associated with obtaining loan funds and investing them in the implementation of agricultural

projects.Conversely, the findings differ with those ofHess [32] whonoted that loan repayment is a financial obligation that is inseparable from financial risks, implying that the loan repayment commitment should not be digressed, even in the face of agroclimatic vagaries.

Furthermore, this study revealed that credit players need to understand how critical agroclimatic extremes are in production and markets and their spillover effect in causing loan default. These extremes measure the extent of bad weather that disrupts farming across value chains by imposing yield stress. With knowledge of agroclimatic extremes, the lender should be alert to having a ready solution on how borrowers will be assisted to overcome this problem. These findings concur with those of Egbeadumah[25],who suggested that stakeholder interventions could be directed at improving farm households to improve their adaptive capacity. The role of institutions such as theAFC (the lender) is to craft mechanisms that will offer supportive intervention to borrowers so that their mission of empowering borrowing farmers will be attained, even in the presence of agroclimatic extremes.

Borrowers should cooperate with lenders in such events and reason together on how to escape the debt traps that have been created by these shocks [31]. They should work in the best interest by avoiding moral hazard, which can cause strategic default [42]. It is imperative for borrowers to bear in mind that agood relationship with their lenders even in the face of shocks is the way forward to solving the problem amicably [27].For government-sponsored loans such as AFC loans, the government should also intervene by mediating amicable solutions between the borrower and the lender. This findingis compatible with the observation ofMarney [39], who observed that agood relationship between credit players is important even in the face of exogenous shocks. As such, loans may eventually be recovered, albeit late [36]. In the study area, the respondents averred that natural hazards did not deter them from their loan serving obligation by being opportunistic of the prevailing circumstance; rather, borrowerswith limited capability were constrained in their capacityto deliver their loan remittances.

3.1.2 Market Volatility

The findings on the repayment distribution based on market volatility show that 57.7% of the borrowers admitted that market conditions were conducive, while 42.3% experienced market failures. This may mean that more borrowers did not suffer unfavourable conditions than fewer who experienced market volatility. The reason is perhaps their production in diversified portfolio streams and engagement in theessential services sector during periods of extraneous shocks. Furthermore, theresults on loan repayment performance status showed that in instances of market failure, there wasa 37% default, while a paltry 8% default was recorded when the market conditions were favourable (Table 4).

Table 4: Loan Repayment Status and Respondents' Market Volatility

Market volatility	Loan status		Respondents' distribution
	Compliance	Default	
Favourable market conditions	159 (92%)	14 (8%)	173 (57.7%)
Market failure indicators	80 (63%)	47 (37%)	127 (42.3%)
Total/Percent	239 (79.7%)	61 (20.3%	300 (100%)

Pearson chi-square =37.8008; df=1; Pvalue = 0.000<0.05

The findings of this study revealed a significant association between market volatility and loan repayment performance at the5% level (p value = 0.000<0.05). This implies that market volatility influenced the loan repayment performance of AFC borrowers such that default escalated with instances of market failure.This is in conformance to the findingsof Abakah [46], who noted that fluctuations in market volatility posed the risk of exposure to both borrowers and lenders. In addition, this study found that volatile markets resulted in unrealistic margins that were insufficient to service the borrowed loans, thus lateness in servicing borrowed loans. This observation is in agreement to the findings ofPutra [45]whoobserved that price volatility made it difficult for farmers to reap sufficient income from sales, thus causing default in farming loans.

Borrowers suggested that supportive intervention from lenders would be forthcoming in solving the problem of market failure. For instance, thedisbursement timeliness of adequate loans would enable borrowers to implement their projects within theirstipulated timings to take advantage of optimum market opportunities.Market volatility constitutes both price volatility and lack of amarket, which affect the revenue cash flows of borrowers, thus hindering loan repayment [44]. Market volatility is a systemic risk-threatening aspect ofborrower operations, and it can be mitigated by lender intervention [42]. Low prices for several agricultural products add to the financial stress that some borrowers are experiencing [41].

The findings of this research emphasized the importance of credit actors who handle agribusiness loan portfolios to understand how critical volatility dynamics in the market are in influencing market failure. Lenders should then offer supportive interventions to borrowers who are affected by this shock. One of the supportive interventions they can recommend is thedisbursement timeliness of adequate loans, which will enable borrowers to implement their projects within theirstipulated timings to take advantage of optimum market opportunities [43]. However, Barko [42] argued that thiscan be mitigated by lender intervention. Rai [28]reported that low prices for several agricultural products add to the financial stress that some borrowers are experiencing.

This study revealed the need for government players to understand their role in controlling brokers in the free-market economy to reduce transaction costs, which cancreate distortions. In addition, the government needs to play a role in regulating market players who may act unethically to create unhealthy competition; craft farmer-friendly policies to counter macroeconomic shocks such as inflation; andoffer supportive intervention in infrastructure and logistics that address market inefficiencies. These findings agree with those of Castro [71] that thegovernment should support risk mitigation. Finally, the government can increase investment in research to provide updated agricultural data on theprices of commodities at various market centres and leverage technology to disseminate information ubiquitously. These observations are congruent with those of Chen [47], who agreed that in the face of market volatility, government intervention was called for to reduce broker-driven markets where sellers suffer due to brokerpricegouging.

3.1.3 Biological Hazards

This study revealed that 31.3% of the respondents were not affected by biological hazards, while 68.7% experienced biological hazards. This means that more borrowers in the area experienced biohazards. In the presence of biological hazards, 33% default was recorded, but in theabsence of biohazards, 14% defaulted (Table 5).

This study revealed a significant association between biological hazards and loan repayment performance at the5% level (p value = 0.000<0.05). Biohazards increased the number of instances of loan default, probably because they affected the prices of some commodities and reduced the number of consumers, resulting in massive losses and theclosure of some enterprises.This created many struggles in therepayment of loans. These findings agreed with those of Hess [32], who observed that crop failure and livestock diseases negativelyaffected loan repayment because they affected the total income generated from agriculture. FAO [11] reported that thehealth of plants and invasive pests were the drivers of biodiversity loss, which eventually exacerbated default in loan repayment. In addition, Ochuba[49]identified pests, diseases and other calamities that affected the yield of crops as triggers for loan default. Finally, Noor [72] reported that thepandemic outbreak increased thedefault rate for agricultural loans.

Table 5: Loan Serving Status and Respondents' Based on Biological Hazards

Biological hazards	Loan status		Respondents' distribution
	Compliance	Default	
Absence of biohazards	173 (86%)	28 (14%)	201 (31.3%)
Presence of biohazards	66 (67%)	33 (33%)	99 (68.7%)
Total/Percent	239 (79.7%)	61 (20.3%)	300 (100%)

Pearson chi-square = 7.5530; df=1; Pvalue = 0.000<0.05

The findings from this study indicate that there is aneed to equip farming communities with knowledge of biological hazards. This point of information will place them at a vantage point where they can predict trends and be able to handle future hazards in case they arise. Dutta [30] concurred with the findings by reporting that knowledge on biological hazards among farming communities was a boon. Loan borrowers provide for future contingencies by taking out crop and livestock insurance to mitigate losses that may arise from crop failure or livestockdeath. This finding is in agreement with those ofMillion [73],who agreed that risk mitigation should be adopted to avert food insecurity. Borrowers can also try to diversify their farming activities to spread risk when market or environmental contingencies arise.

Based on the findings of this study, there isaneed for lenders to respond to biological hazards by providing flexible loan repayment schedules so that they can recover loan funds and at the same time maintain their relationships as they meet social objectives. Consistent with this observation, Asadov [50] agreed that repayment flexibility was the solution to loan contracts when hazards hit. The government responds to social crises by playing interventionist roles. In such cases, thegovernment can engage subsidies to inject into borrowers' projects so that they will have money to service their obligations and repay the loan. Peck Christen [40] agreed that government subsidies helped in resolving loan default problems caused by biohazards.

3.2Description of the Econometric Models

3.2.1The Effect of Extraneous Shocks on theAFC Loan Default Rate.

Multiple regression analysis was performed to assess the impact of extraneous shocks on theAFC loan default rate. The regression equation was as follows:

$$Y = \beta_0 + \beta_{14}X_{14} + \beta_{15}X_{15} + \beta_{16}X_{16} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(i)}$$

The model summary for theeffect of extraneous shocks and theAFC loan default rate is tabulated hereunder. The adjusted R squared (R^2) of the regression model shows that extraneous shocks account for 0.231 (23.1%) of the AFC loan defaults. The adjusted R square (Adj. R^2) of 0.231 was close to R^2 (0.239), indicating that theoutliers were not significant. The pvalue = 0.000 wasless than 0.05, implying that the model had a 5% level of significance (Table 6).

Table 6: Model summary for extraneous shocks and theAFC loan default rate

Model	R	R Square	Adjusted R square	Std. error of the estimate
1	0.489^a	0.239	0.231	0.340

a. Dependent variable: AFC loan default rate

The ANOVA for extraneous shocks and theAFC loan default rate revealed that the presence of agroclimatic extremes, market volatility and biological hazards had a positive and significant effect on the AFC loan default rate at 5% (Table 7).

Table 7: ANOVA for extraneous shocks and theAFC loan default rate

Model		Sum of squares	Df	Mean square	F	Sig.
	Regression	10.730	3	3.577	30.968	0.000^b
1	Residual	34.187	296	0.115		
	Total	44.917	299			

b. Predictors: (constant), presence of agroclimatic extremes, market volatility and biological hazards.

The coefficients for the extraneous shocks affecting theAFC loan default rate showed that agroclimatic extremes are felt in the sense that they are associated with a21.6% default rate (Table 8).

Table 8: Coefficients for the effects of extraneous shocks on the AFC loan default rate

Model	Unstandardized coefficients		Standardized coefficients	T	Sig.
	B	Std. Error	Beta		
Constant	0.151	0.042		1.017	0.001
Climate extremes	0.216	0.042	0.261	5.134	0.000
Market volatility	0.305	0.040	0.391	7.676	0.000
Biological hazards	0.169	0.042	0.208	4.093	0.000

The findings imply that efforts by the borrowers to repay the loans when due were affected by adverse climatic conditions. Market volatility is associated with a30.5% increase in thedefault rate, implying that the presence of market failure led to adecline in the funds available to service loans, thus increasing theAFC default rate. Biological hazards led to a 16.9% increase in thedefault rate (Table 8).
The equation for the extraneous shocks is as follows:

$$Y = 0.15 + 0.216\, X_{12} + 0.305\, X_{13} + 0.169 X_{14} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

The findings imply that extraneous shocks negatively impact agribusiness activities,which are meant to be the source of revenue to service loans, thereby increasing the probability of default by borrowers. The study therefore established that extraneous shocks can predict theAFC loan default rate. These findings are consistent with those of He [35],who reported that adverse shocks affected the quality of loan portfolios and made borrowers vulnerable by reducing their revenue streams, thereby increasing the likelihood that they would plunge into loan repayment difficulties.Irungu [74]observed that extraneous shocks introduced untold risks to farming communities, which affected production and marketing, thereby causing loan servicing challenges for agribusiness borrowers.

CONCLUSION

Extraneous shocks are a harbinger for risks that can affect lending cycles. Both lenders and borrowers need to provide for contingencies and be alert to cope with attendant vagaries when they eventually hit. The study revealed that these shocks are sources of production, marketing and financial risks that hinder the repayment of agricultural loans. As such, they would be able to proceed with their operations even during periods of extraneous shocks. Agroclimatic extremes and biological hazards are associated with environmental and natural hazards that occur unexpectedly, thus causing production risks. Market volatility presents market dynamics associated with thevolatility of prices and price mechanisms that introduce market failure. It characterizes distortions linked to market risks, which are a great constraint to marketing efficiency. Both borrowers and lenders should take precautionary measures during loan cycles to absorb risks emanating from shocks. As such, they would be able to proceed with their operations even during periods of extraneous shocks. Notably, climate change is acontemporary reality that needs to be factored in planning and accounted for in budgeting. The study recommends the need for credit players to take precautionary measures and be alert to absorb risks emanating from shocks when they eventually hit; additionally, credit players need to collaborate in pursuit of bespoke insurance schemes that can suitably cover farmer projects.The implicationof this study is to illuminate the credit stakeholders on the contemporary vulnerabilities that the farming communities contend with, emanating from the emerging and devastating constraints of extraneous shocks and eventually trickling down to the loans default, thus inspiring coping behaviours to proceed with farming practices even in the presence of vagaries. For instance, Government may also be guided protectionism policy in regard to productionand politicalrisks so as to minimize yield stress. This may be achieved by intervention in availing affordable insurance schemes. Besides, it may be possible internalize production and market risks and the attendant extraneous shocks; this may inspire collaborations and partnerships in mitigating these shocks. During the study there were some limitations such as: strain in locating respondents who were domiciled in remote countryside. This limitation was overcome by engaging AFC staff who accompanied or gave maps to locate those areas. Some respondents intended to evade some questions. However, rephrasing and elaboration of the questions was done later so as to eliminate instances of non-response.

This study suggests the following areas for future research: the effect of macroeconomic shocks and government policies on performance of agribusiness loans; and the role of climate variability on performance of credit market and sustainability of the farm sector.

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