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

ABSTRACT

Agri-shocks create stochastic disturbances to agribusiness performance which spills over to the performance of credit markets. The beneficiaries of farm loans from Agricultural Finance Corporation (AFC) in Mount Kenya Region have recorded poor loan repayment at a rate of 20.33% against 10% which is the benchmark for all types of loans in Kenya. Given that agribusiness is a priority sector in addressing food and employment concerns, the performance of agri-loans is sacrosanct. This study meant to determinetheeffectofextraneousshocksonagribusinessloansdefaultrate inagricultural finance corporation, Mount Kenya Region. In11 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 adescriptive design using a structured questionnaire, primarydata was collected on the effect of extraneous shocks on AFC loans default rate. To analyse data, Statistical Packages for Social Sciences (SPSS V.27) was used. The effect of variables in predicting default rate was estimated using regression analysis. To derive the F-statistic in order to test the adequacy of the regression model, ANOVA was performed. Multipleregressionmodel was used to specify the statistical relationship between extraneous shocks and AFC loan default. The model estimates revealed that the three indicators of extraneous shocks explained 23.90% of AFC loan default rate. Two indicators (agroclimatic extremes and market volatility positively and significantly effected AFC loans default rate at 5% level of significance (p-values=0.00<0.05). The associations of indicators with default rate were: agroclimatic extremes (21.7%), market volatility (30.6%) and biological hazards (17.3%). The study is significant because it may guide the credit stakeholders on the strategic imperatives pointing to interventionist policies through protectionism, partnerships, mitigation and internalization of extraneous shocks. The study recommends the need for loan actors to provide for contingencies and be alert so as to absorb risks emanating from shocks. Credit players should collaborate in pursuit of bespoke insurance schemes which can suitably cover farmer projects; lastly, credit stakeholders should adopt coping strategies so as to cushion farmers from emerging distresses and devastating constraints.

Key words: AFCloan;default rate; borrower: extraneous shocks: repayment.

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 and originates from outside the operations of the phenomena and have an impactthat is significant and visible [2]. Their impacts of extreme events create stochastic perturbations that creates disturbances to 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 climate-friendly [4]. However, banks do not reduce credit flows indiscriminately as they shield their core markets strategically [5].Shocks present decision makers with limited information and knowhow, regarding the occurrence of

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outcome linked to a certain course of action [6].

The effect of extraneous shocks is the risk outcomes such as decline in agricultural productivity and poor performance in credit markets[7].Risk management knowledge may equip the borrower with skills to overcome revenue loss [8].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[9]. Production risks emanate from bad weather and they influence the ensuing price spikes [10]. Farmers also experienced institutional risk, which are tied to unforeseen changes in government policy [11]. Risks cause spillover effect by producing different risky outcomes [12].For example, flooding may engender financial and human risks which makes it hard to realize the projected yield [13]. This makes it hard to raise money for loan repayment, thus making compliance in loan repayment a mirage [14].Risk implies that farm decisions are met with uncertainty about the occurrence of an event which causes unpredictability in farming business[15]. Extraneous shocks cause transition risks which occur as costs to enterprise due to unforeseen climatic happenings [16]. Ultimately, loan default arises because it is a risk eventuality which borrowing farmers had not anticipated [17].

Past studies have linked extraneous shocks to agribusiness loan default:Kanwal[18] observed that there was high perception of bad weather; flooding area compelled the households to be proactively engaged in control measures and also monitor risks so as to reduce loan default. Hess [19] reported that agricultural enterprises were integrally knotted on unpredictablecircumstances hence the constraints and uncertainties which point tolow yield risk. Theimpactsofcovid-19 and floods caused disbursement lag; decrease the value of loans accessed by farmers, increased cost and effort during loan recovery, thus increasing default in loans. Kibrom[20]agreedthat market problems such as market unpredictability, price volatility and insufficient marketing channels are the main cause of default in agribusiness credit. These studies exhibit a methodological, conceptual and contextual gaps. To address the gaps, this study analysed the variable on a broader perspective by studying a whole region, adopting more indicators and increasing the sample size.

Shocks induce risks in the aspects of producing, pricing, financing and to the institution and human [21]. Shocks includepricedisparityand fluctuations [22]; bad weatherchallengessuch as drought, flooding, strong winds and depressed rainfall [23]; variability in soil quality Suppan [24] and natural hazards such as pest and disease infestations, flooding, fire disaster, thunder and lightning. They are also indicated inweather, pests, floods,and disease orprice variability and they reduce farm production income, thus making loan repayment difficult [25].This study adopted three indicators which extraneously effected default in AFC agribusiness loan. These includes: agroclimatic extremes, market volatility and biological hazards.The objective of this study is todeterminetheeffectofextraneousshocksonAFCloandefaultrate.Extraneous shocks impact on agribusiness projects thus contributing tremendously to the problem of default which hinders sustainable recycling of farm loans; if unchecked, the trend would make the future of credit markets to be bleak since agribusiness investors would be risk averse, thus declining to borrow and use loans in farming.

Agroclimatic extremes are indicated in drought which is the main element [26]. This

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is because drought is a template for how climate change-induced water shortages could impact farming communities in the future [18].Even if farmers rely on irrigated agriculture, drought brings great water shortage since the available amount would be prioritized to be taken to urban centres than to agriculture [16].Agricultural production is intrinsically hooked on weather uncertainties especially in relation rain fluctuation [27].Bad weather events caused enormous damage to the economy and risk to the lender if loans were not insured [28].Extreme climatic anomalies exert biophysical stress and is a source of yield fluctuation in harvest- failure scenarios thus indicating yield stress [29].

Market volatility is caused by inelastic response to market gestures, deficiency of infrastructure, risk of production occasioned by vagaries of agroclimatic circumstances and outset of diseases [30]. Consequently, volatility may not stabilize prices thus causing delivery of low volumes of produce and constraining producer's strategy of participating in the marketplace [31]. Market volatility increases the cost of borrowed capital because the prices are distorted bringing financial losses and wasted labour [32].Agricultural markets are characterised by volatile market dynamics [33]. Any sudden market change alters commodity prices due to shortage or surplus; this depresses the borrower's revenue hence resulting to loan default [34].

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 to diseases transmitted by vectors [35].Infiltration of the environment by pests and diseases affects credit markets by limiting access to agricultural loans and credit [36]. This also hampers the performance of loans that are already being repaid [37]. Therefore, they are not accounted for as provisions during preparation for project undertaking [38]. Covid-19 caused yield stress and unprecedented disbursement delayswhich increased the cost and effort during loan recovery, thus increasing default in loans [39]. The recent occurrence of biohazards in Kenya changed the food security situation and agricultural livelihoods which resulted in chaos and disruption culminating into credit crisis [40].

RESEARCH METHODOLOGY

3.1 StudyArea

The study was conducted between June 2022 and December 2022 in Mount Kenya region, which is one of the AFC catchment areas within the country. This region was selected through convenience sampling because of good branch network, variety of agribusiness activities and agroclimatic zones. The GPS coordinates of this region are 36.561, 2.168 and 37. 852, -0.85 [41]. The branch network of this region comprises of 11 branches which includes Meru, Chogoria, Embu, Kerugoya, Thika, Murang'a, Nyahururu, Maralal, Nanyuki, Nyeri and Karatina. These branches are spread in the 9 counties which include Meru, Tharaka-Nithi, Embu, Kirinyaga,Kiambu,Murang'a,Samburu,LaikipiaandNyeri.

3.2 ResearchDesign

The study used descriptive research design. The aim of this design is to systematically obtain information so as to be in a position of phenomenon description, describe a

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situation, or population [42]. The design utilizesa myriadofresearchmethodsto explore the variables inquestionbychieflyemploying quantitative data for descriptive purposes, collection and analysis of numerical data [43]. This design was accurate and systematic in collecting and describing extraneous shocks in Mount Kenya region, the default problem and the determinants of default. The choice of this design was guided by the possibility of using diversemethods of research to examine, observe and measure variables which concern default in agribusiness loans in AFC. This design was adopted by Chege [44] in examining practices of managing loans and credit non-repayment AFC, Kenya. In addition, Adusei [45]adopted this design to study the determinants of agribusiness entities loan default in Ghana. Mwirigi [46] used descriptive research design to study managing relationships of customers and Satisfaction of Account Holders of Commercial Banks in Nairobi County, Kenya.

3.3 Population, SamplingProcedures and Sample Size Determination

3.3.1 Study Population

The population of study was farmers who have borrowed agribusiness loans from the 11 branches of Mount Kenya region for the period 2018/2022. All agribusiness loans disbursed by AFC are serviced in 36 months. These borrowers comprise of all current beneficiaries withoutregardtotheirloanlevelandrepaymentperformance.TheAgriculturalFinance Corporationbranchreportsof 2022 showtheperformanceofborrowerswhoareservicing3-yearagribusiness loanstotallingto3,002 (Table1).

Table 1: Distribution of Borrowers, Respondents and Default 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)

3.3.2 SamplingProcedures

The population was 3,002 borrowers from which sampling was designed to identify the default cases and non-default cases (controls). Default was for all those with loans whose repayments were not regularized regardless of cause of noncompliance. The controls were selected based on absence of history of nonconformity. From AFC records as per close of financial year 2022, there were 3,002 agribusiness borrowers in Mount Kenya region.Using systematic random sampling method with a ‘skip’ of

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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 the interval of 10, overconcentration in one branch was eliminated, thus fair distribution whichguaranteed representativeness. With this interval, the count loops fromanypoint to finish the count that is required. Besides, the interval guarantees that the sample is drawn from both defaulters and non-defaulters [47]. To conductsampling anelement wasselectedfromthe list randomly and then everyk^{th}element in the frame is picked. 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 thus:k= 3,002/300 = 10. This means that, the respondents were selected fromAFC list at random after skipping ten.

3.3.3 SampleSizeDetermination
It was important to select a sample to represent population from a comparatively similar population. Stratification aims to reduce the standard error by providing some control over variance. To calculate the size of the sample Daniel [48] formula was used as follows:

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

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):Forthelevelof confidenceof 95%,whichisconventional,Zvalueis 1.96.Inthesestudies,investigatorspresenttheirresultswith95%confidence intervals(CI).

Using 1.96 as the standard deviation for 95% level of confidence, with known sample size and a known proportion, precision can be determined. To calculate the margin of error, the non-negative square root is considered [49].In our case, there were 3,002 agribusiness loan beneficiaries.Defaulters represented 24.15% of the total beneficiaries.To the sample size the following calculation was done:

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

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

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

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), andd = precision (in proportion of

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one; if 5%, d = 0.05).At confidence levelof 95%,Zvalueis1.96.Toestablish the sample size the calculation was done given that default 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

3.4 PilotStudy

Pilot study was conducted in Central Rift region where respondents were drawn from 4 branches namely Nakuru, Naivasha, Molo and Kericho using 30 respondents who are 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. Central rift is more similar to Mount Kenya due to its weather conditions and diversity of agribusiness projects. Pilot study helped to identify ifquestionnaires were ambiguous, unclear or biased so asto determine the necessaryadjustments that couldbe made to data collection instruments. It was used to determine the feasibilityofresearchdesign formingapreliminary, small-scale "rehearsal" in whichtotestthe methodsplanned for use in the research project [50]. The results were used to guide the methodology of the large-scale investigation. The recommended overall sample size of 30 of the pilot study especially when the pilot study sample is 10% of the sample projected for the larger parent study [51].

3.5 Validity

The studyemployeda questionnaire whichwas tailored keenlyand thoroughlyto ensure that allrelevant material facts were captured. This was to ensure accuracyand accommodation of allpertinentdetails.ThestructuredquestionnairewaspilottestedinCentral rift regionat Nakuru, Kericho, Molo and Naivasha branches.Thisestablisheditsrelevancetothestudyproducing accurate results.Construct validitywas achieved throughthe operationalization of the variables which reflected the theoretical assumptions that supported the conceptual framework of the study [52]. Content validity was done 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 moderation of extraneous shocks. Criterion related validity of the conceptual framework was determined by examining the multiple correlation coefficients of all the independent variables and the measure of dependent variable [53].

3.6 Reliability

Reliability of the research instrument (questionnaire) was evaluated using Cronbach Coefficient Alpha. Evaluation of questionnaire was done by estimating the internal consistency of responses so as to examine the reliability of scales. Cronbach's alpha is appropriate for dichotomous variables coded as 0 or 1 [54]. Zero means that there is no internal consistency between items in the questionnaire while one means that internal consistency is perfect [55]. 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 [56]. Results from this study indicated that the questionnaire was reliable since the scale reliability coefficient was 0.7318>0.7 which is the acceptable

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scale. This is because the Cronbach's Alpha values for different dimensions of the present study are more than 0.7, meaning the data are taken as sufficiently reliable and consistent (Table 2).

Table 2: Reliability Test Using Cronbach Alpha

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

George [57]provided 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 [58] who agreed that the value of more than 0.7 in Cronbach's Alpha indicates that collected data was sufficiently reliable and consistent.

3.7DataCollection

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 socio-economic profile, their decision making about enterprises, their lender behavioural characteristics and the extraneous shocks which catch up with themas the project cycle progresses. Primarydata was obtained from the respondents who were current beneficiaries of AFC farm loan. Secondary data 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 them to suggest how they could be reachedforinterview.Allrespondentswereguidedonhowtoanswerquestionsby enumerators. The secondary data that was collected included data on performance of branches, type of loan products, administrative units and agribusiness activities.

3.8DataAnalysis

3.8.1 DataAnalysisTechniquesandTools

3.8.1 DataAnalysisTechniquesandTools

The software for analysis was Statistical Packages for Social Sciences (SPSS V. 27.0).The output from quantitative data was given in descriptive statistics and regression analysis.Regression analysis was used to describe the relationship between independent and dependent variables. The econometric models that were used include Logit, binary logistic regression, probit and the multiple linear and stepwise regression models. Each of the objectives was regressed using its own model respectively. Correlation analysis was used to evaluate the strength of a relationship between the variables. This is because correlation analysis illustrates both the direction and the strength of the relationship between the two variables [59]. ANOVA was performed to get the F-statistic so as to test for the adequacy of the regression model.

3.8.2ModelSpecification

3.8.2.4 TodeterminetheeffectofExtraneousshocksonAFCloandefaultrate

Theappropriatemodelintheachievementof thisobjectiveismultipleregressionmodels. The regression equations were formulated as follows:

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$Y=\beta_0+\beta_1 X_1+\beta_2 X_2+\beta_3 X_3+\varepsilon$…….. (i)

where, the probability to default or comply in loan repayment is influenced by extraneous shocks. Y= AFC default rate;β_0= Constant β_1 − β_3= Regression Coefficients;ε= Error term; X_1=Agroclimatic extremes; X_2=market volatility and X_3= biological hazards.

RESULTS AND DISCUSSION

4.5 The Effect of Extraneous Shocks on AFC Loan Default Rate

4.5.1 Agroclimatic Extremes

The loan repayment distribution on the basis of agroclimatic imply that 31.7% of borrowers experienced favourable conditions while 68.3% were victims of bad weather. This means that majority of borrowers in the area of study experienced bad weather than their minority counterparts who were not affected by harsh weather conditions. Further, the repayment performance indicates that 54% default rate was registered due to extremities in weather. There was high loan repayment performance in favour of borrowers who were not affected by bad weather who registered a paltry 8% 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; P-value = 0.000<0.05

The findings of this study established that there existed significant association between agroclimatic extremes and loan repayment performance at 5% level of significance (P-value = 0.000<0.05). The implication is that shocks associated with agroclimatic extremes influenced the loan repayment performance by AFC borrowers. Bad weather exacerbates default problem among the farming communities. The likely reason is mainly due to yield stress caused by crop failure. Since the occurrence is an unforeseen event, there is a possibility of adjusting to absorb more costs so as avoid project collapse. Production and market risks result to financial risk which is associated with obtaining loan funds and investing them in the implementation of agricultural project.

The findings of this study agree with those of Komarek [21] who reported that agroclimatic extremes contributes to multiple risks which hampers production, marketing and the finance availability thus increasing the probability of default in agribusiness loans. Hess [19] noted that loan repayment is a financial obligation that is inseparable from financial risks such as non-compliance in remitting loan repayments. Kibrom[20]reported that adverse weather conditions represented significant risks for agricultural sectors and geographic regions. These challenges cause default in loans disbursed for project execution [7].

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Further, this study observed that credit players need to understand how critical the agroclimatic extremes were in production and market and their spillover effect in causing loan default. These extremes measure the extent of bad weather that is disruptive to farming across the value chains by imposing yield stress. With knowledge of agroclimatic extremes, the lender should be alert by having a ready solution on how borrowers will be assisted to get over the matter. These findings are in concurrence with to those of Egbeadumah [12] who suggested that stakeholder interventions could be directed at improving farm households so as to improve their adaptive capacity. The role of institutions such as AFC (the lender) is to craft mechanisms which will offer supportive intervention to the borrowers so that their mission of empowering borrowing farmers will be attained, even with presence of agroclimatic extremes.

Borrowers should cooperate with lenders in such events and reason together on how to get out of debt trap that has been created by these shocks [18]. They should work in the best interest by avoiding moral hazard which brings strategic default [16]. It is imperative for borrowers to bear in mind that good relationship with their lenders even in the face of shocks is the way forward to solving the problem amicably [14]. For government sponsored-loans like AFC loans, the government should also intervene by mediating in amicable solutions between the borrower and the lender. This is compatible to the observation by Marney [13] who observed that good relationship between credit players is important even in the face of exogenous shocks. As such, loans may be eventually recovered, albeit late [10]. In the study area, it was noted that natural hazards did not make borrowers to take advantage and default if they had the capacity, but only those of limited capability failed to deliver their loan remittances.

4.5.2 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 as compared fewer who experienced market volatility. The reason is perhaps their production in diversified portfolio streams and engagement in essential services sector during the periods of extraneous shocks. Further, results on loan repayment performance status showed that in instances of market failure there is 37% default while a paltry 8% default was recorded when the market conditions are favourable (Table 4).

Table 4: Loan Repayment Status and Respondents' Based on 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; P-value = 0.000<0.05

The findings of this study established the existence of significant association between market volatility and loan repayment performance at 5% level of significance (p-value = 0.000<0.05). This implies that market volatility influenced the loan

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repayment performance by AFC borrowers such that default escalated with instances of market failures.Volatile markets resulted in unrealistic margins which were insufficient to service the borrowed loans, thus lateness in servicing borrowed loans. Borrowers suggested that supportive intervention from lenders would be forthcoming in solving the problem of market failure. For instance, disbursement timeliness of adequate loans would enable borrowers to implement their projects within stipulated timings so as to take advantage of optimum market opportunities.

These findings are in conformance to those of Abakah [33] who noted that fluctuations in market volatility posed the risk of exposure to both borrowers and lenders. Putra [32] observed that price volatility made it hard for farmers to reap sufficient income from sales, thus causing default in farming loans. Market volatility constitutes both price volatility and lack of marketwhich affected the revenue cashflows of the borrower thus hindering loan repayment [31].Market volatility is a systemic risk threatening borrower operations and it can be mitigated by lender's intervention [29].Low prices for several agricultural products add to the financial stress that some borrowers are experiencing[28].

The findings of this research emphasized the importance for credit actors who handle agribusiness loan portfolio to understand how critical the volatility dynamics in the market are in influencing market failure. Lenders should then offer supportive interventions to borrowers who are affected by this nature of shocks. One of the supportive interventions they can recommend is disbursement timeliness of adequate loans which will enable borrowers to implement their projects within stipulated timings so as to take advantage of optimum market opportunities [30]. This is consistent with the observation by Mieg[8]who concluded that market volatility is a systemic risk threatening borrower operations. However, Barko [29] argued that it can be mitigated by lender's intervention. Rai [28] reported that low prices for several agricultural products add to the financial stress that some borrowers are experiencing.

This study found the necessity for the government players to understand their role in controlling brokers in the free market economy so as to cut transaction costs which create distortions. Besides, the government need to play its role in regulating the market players who may act unethically to create unhealthy competition; craft farmer-friendly policies to counter macroeconomic shocks such as inflation; offer supportive intervention in infrastructure and logistics that address market inefficiencies. These findings agree with those of Castro [60]that government should support in risk mitigation. Lastly, government can increase investment in research so as to provide updated agriculture data on prices of commodities at various market centres and leverage on technology to disseminate the information ubiquitously. These observations are congruent with those of Chen [34] who agreed that in the face of market volatility government intervention was called for so as to reduce broker driven markets where sellers suffered due to broker's pricegouging.

4.5.3 Biological Hazards

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

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Table 5: Loan Servicing 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; P-value = 0.000<0.05

This study found that there exist significant association between biological hazards and loan repayment performance at 5% level of significance (P-value = 0.000<0.05). Biohazards increased the instances of loan default probably because they affected the prices of some commodities and also reduced the number of consumers resulting in massive losses and closure of some enterprises. This created a lot of struggles in repayment of loans. These findings agreed with those of Hess [19]who observed that crop failure and livestock diseases affected loan repayment negatively because they affected the total income generated from agriculture. FAO [35] reported that health of plants and invasive pests were the drivers of biodiversity loss which eventually exacerbated default in loan repayment. In addition, Ochuba [37] identified, pests, diseases and other calamities which affected the yield of crops as trigger for loan default. Lastly, Noor [61] reported that pandemic outbreak increased default rate in agricultural loans.

The findings from this study informs that there is need 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 [17] concurred with the findings by reporting that knowledge on biological hazards among the farming communities was a boon. Loan borrowers provide for future contingencies by taking out crop and livestock insurance to mitigate against losses which may arise due crop failure or death of livestock. This finding agrees with Million [62] who agreed that risk mitigation should be adopted to avert food insecurity. Borrowers can also try to diversify their farming activities so to so as to spread risk in case market or environmental contingencies arise.

Based on the findings of this study, there was need for lenders to respond to biological hazards by giving flexible loan repayment schedules so that they can recover loan funds and at the same time maintain their relationship as they meet social objectives. Consistent to this observation, Asadov [38] agreed that repayment flexibility was the solution to loan contracts when hazards hit. The government responds to social crisis by playing interventionist roles. In such case, government can engage subsidies to inject in borrower's projects so that they will have money to service their obligations and repay the loan. Peck Christen [27] agreed that government subsidy helped in resolving loan default problems caused by biohazards.

4.6 Description of the Econometric Models on the Effect of Borrower Socio-

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economic Profile on AFC Loan DefaultRate

4.6.4 The Effect of Extraneous Shocks on AFC Loan Default Rate.

Multiple regression analysis was done to assess the moderating impact of extraneous shocks on AFC loan default rate. The regression equation formulated 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 effect of extraneous shocks and AFC loan default rate is tabulated hereunder. The Adjusted R squared (R^2) of the regression model depicts that extraneous shocks accounts for 0.231 (23.1%) of the AFC loan defaults. Adjusted R Square (Adj. R^2) of 0.231 was a figure close to R^2 (0.239) thus indicating that outliers were not significant. The p-value = 0.000 less than 0.05 implying that the model had a 5% level of significance (Table 6).

Table 6: Model summary for extraneous shocks and AFC 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 AFC loan default rate revealed that the presence of agroclimatic extremes, market volatility and biological hazards had a positive and significant effect on the AFC loans default rate at 5% (Table 7).

Table 7: ANOVA for extraneous shocks and AFC 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 AFC loan default rate showed that agroclimatic extremes are felt in the sense that it is associated with 21.6% default rate. The findings imply that efforts by the borrowers to repay the loans when due was affected by adverse climatic conditions. Market volatility is associated with 30.5% increase in default rate implying that the presence of market failure led to decline in the funds available to service the loans thus increasing AFC default rate. Biological hazards lead to a 16.9% increase in default rate (Table 8).

Table 8: Coefficients for the extraneous shocks affecting 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 equation for the extraneous shocks is as follows:

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

The findings imply that extraneous shocks negatively impacted the agribusiness activities meant to be the source of revenue to service the loans therefore increasing the probability of default by the borrowers. The study therefore established that extraneous shocks can predict AFC loan default rate. These finding are consistent with those of He [22] who reported that adverse shocks affected the quality of loan portfolio and made borrowers vulnerable by reducing their revenue streams, thereby increasing the likelihood that they would plunge into loan repayment difficulties.Irungu[63] observed that extraneous shocks introduced untold risks to farming communities which affected production and marketing thereby causing loan servicing challenges to agribusiness borrowers.

5.2 CONCLUSION

Extraneous shocks are a harbinger for risks which can affect lending cycles. Both lenders and borrowers need to provide for contingencies and be alert so as to cope with attendant vagaries when they eventually hit. The study found that these shocks are the source of production, marketing and financial risks which encumber repayment of agricultural loans. As such, they would be able to proceed with their operations even during the periods of extraneous shocks.Agroclimatic extremes and biological hazards are associate with environmental and natural hazards that occur unexpectedly, thus causing production risks. Market volatility presents market dynamics associated with volatility of prices and price mechanisms which introduce market failure. It characterises distortions linked to market risks which are a great constraint to marketing efficiency.Both borrowers and lenders should take precautionary measures during loan cycles so as to absorb risks emanating from shocks. As such, they would be able to proceed with their operations even during the periods of extraneous shocks. It is noteworthy that climate change is contemporary reality which need 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 so as to absorb risks emanating from shocks when they eventually hit; also, credit players need to collaborate in pursuit of bespoke insurance schemes which can suitably cover farmer projects.

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