Original Research Article

Response of Poultry Agribusiness Risk to Financial Fragility and Macroeconomic Shocks in Nigeria (2004-2009)

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Abstract

Financial Fragility and Macroeconomic shocks make poultry agribusiness vulnerable to risk (unsteady profit). This tends to dampen investment drive and inhabits aggregate growth in the poultry sub-sector in Nigeria. To address this problem, time series data of 6 years (2004-2009) were collected from 200 randomly selected poultry farms. Multiple regression and t-test were used to analyse the collected data. T-test of return on investment shows that poultry agribusiness has low financial fragility and could be resilient enough to withstand macro-economic shocks. Co-integration results indicate that poultry agribusiness risks moves together with inflation rate, interest rates and real exchange rate. According to the results of vector autoregressive (VAR) test, it is shown that poultry agri-business risk is sensitive to macroeconomic shocks. But with sound financial structure, poultry agribusiness will be able to withstand financial fragility. The impacts–response analysis shows that increase in macroeconomic distortions leads to increase in poultry agribusiness risk in Nigeria. The results of study provided information on how macro economic shocks and fragile financial structure can trigger risk in poultry agribusiness sector. This information is very crucial to effective policy making and economic planning that will bring development to the poultry sector and the Nigerian economy. Factor analysis confirmed that inflation rate (0.0039) and interest rates (0.1218) are the significant distortion factors ($P < 0.01$) that exert more impact on poultry agribusiness risk. Regulated interest and inflation rates would stabilize earnings and lead to growth in poultry agribusiness in Nigeria.

Keywords: Investment; regulation; macroeconomic variables.

INTRODUCTION

The poultry industry is of considerable economic relevance because it serves as a source of food, income, employment and poverty alleviation (Bosnjak and Rodic, 2008; Hodges, 2009). In spite of the increased relevance of the poultry sub-sector, further growth is required. Yet macro-economic shocks tend to introduce risk into the poultry industry. This is capable of adversely affecting about 30 million people who depend on the industry for survival. Agribusiness risk arises from the operational characteristics of the poultry firms such as unstable cost structure, unsteady demand and business cycle. An error in management could lead to a big loss of revenue. Risk is a limitation to the growth of poultry industry. Unsteady business cycle could affect the financial position of the poultry agribusiness. This can result in both earnings and capital loss. Central Bank of Nigeria (CBN) (2008) has identified multivariate macroeconomic risk factors. These include interest rate risk, foreign exchange risk, inflation rate risk, and bank lending rate risk. But the dimension of impact of these factors on poultry agribusiness is yet to be investigated.

These macroeconomic variables could have their separate assumptions in relation to poultry business risk. In this study, variation of macroeconomic variables over time is referred to as macro-economic shocks or distortion. Macroeconomic shock impact analysis, measures how poultry financial return co-varies with the swings of the economy (Oladeji, 2005)

Macro economic shocks could have some influence on the prices of poultry inputs and output, directly or indirectly. One of the biggest challenges affecting the poultry sub-sector in Nigeria (affecting both large and small scale producers) is risk. Such risk basically includes production risk, market risk and financial risk. The price of poultry inputs and outputs are very unstable and fluctuates considerably over time and space.

One pertinent risk that agitates the mind of agribusiness researchers is whether poultry producers adopt management strategies to adapt to macroeconomic distortions. Poultry investors face risk and uncertainty in making investment decision because of incomplete information on the pattern of macroeconomic distortions. They cannot make profit maximizing decisions if they are not properly informed on the effect of macroeconomic shocks on poultry agribusiness. Hence comprehensive information on the economy is critical to risk mitigation in business. Economists measure the value of market information as the difference in risk levels with respect to incomplete and complete information availability. Changes in government economic policies such as fuel price policies, exchange rate regime, interest rate and inflation rate explain why the prices of all factors of production and product prices in the poultry sector tend to swing upward or downward over time.

Macro-economic shocks are often beyond the control of the farm manager. However, the farm manager can

devise coping strategies. Exchange rates are determined by the forces of demand and supply for currency (World Bank, 2008). To that extent, the exchange rate reveals the purchasing power of the currency (Iyoha et al., 2003). Unstable exchange rate usually leads to instability in terms of trade. It creates uncertainties in the domestic economy. Capital movements respond to changes in the rate of interest. If the rate of interest on capital is higher, than the rate of return on investment, investors find it difficult to repay borrowed fund and thereby suffer credit risk (World Bank, 2008). Fluctuation of rate of inflation in Nigeria and its corresponding effects on producers and consumers has been documented by many authors (Moser, 1995; Robert, 2008; and Yusuf et al., 2009). Yusuf et al. (2009) posited that the obvious signs of inflation include increase in wages and salaries, increases in the prices of food items, increase in the cost of production, leading to decrease real wages. Robert (2008), accordingly stressed that inflation could wipe out the gains of investors. This is an indication of financial risk to the producers.

FAO (2009) recommended that risk analysis should include all critical risk, factors such as macroeconomic distortions. The degree of response of an enterprise to macro economic shocks (systematic risk) varies across industries (Williams and Hein, 1986). An assessment of the response of poultry business risk to macroeconomic shocks is imperative since it tends to erode the confidence of stakeholders considering investment in the poultry sub-sector. Growth policy for this sector can only be possible on the basis of accurate knowledge of the correlation between poultry agribusiness and macro economic shocks. There is a dearth of empirical data on this subject matter. This is a gap that this research was designed to fill. Our study was designed to provide answers to the following research questions: (i) does poultry enterprise respond to macroeconomic distortions? (ii) What are the critical macroeconomic variables that affect poultry agribusiness risk in Nigeria?

The specific objectives of this study were to:

i. examine the financial fragility in poultry agribusiness
ii. investigate the resilience of poultry agribusiness to macroeconomic shocks.
iii. identify the critical macroeconomic shock variables that affect poultry agribusiness risk in Nigeria.

Ho_1: Macroeconomic shocks do not have joint significant effect on poultry agribusiness risk in Nigeria.

Ho_2: The selected macroeconomic variables do not have individual significant effect on poultry agribusiness risk in Nigeria.

Theoretical Framework

This investigation was predicted on the allied theories of macroeconomic shocks and financial fragility. Macroeconomic shocks or a surprise involves the variation of macroeconomic variable overtime. It means dispersion of macroeconomic. It means dispersion of macroeconomic variables from expected or published values. The shocks may be positive or negative (Oladeji, 2005).

Financial fragility is the vulnerability of a system to financial crisis. It is the degree to which small shocks have disproportionately large effects. In macroeconomics, the term financial fragility is used to refer to a systems' susceptibility to large-scale financial crisis caused by small routine economic shocks (Allen and Gala, 2004). To that extent, a small change in macroeconomic variables (inflation rate, interest rate and exchange rate) can trigger a large swing in prices. A system with fragile capital structure will be more vulnerable.

Understanding how the poultry agribusiness is influenced by macroeconomic environment is crucial to the policy makers in the sector. As a result, a micro-macro framework was considered relevant and appropriate for this study, following De Graeve et al. (2008). The micro component explains the risk probabilities or exposures of poultry agribusiness, while the macro component is described by a vector Auto regressive model. The appealing feature of this construct is that it allows for contemporaneous feedback effects between the poultry agribusiness (micro) and macroeconomic shocks.

MATERIALS AND METHODS

Time series data were collected from 200 randomly selected respondent poultry farmers and CBN yearly publications. The historical data used for the study covered from 2004 to 2009. Time series data was considered appropriate for this study because it gives more informative data, more variability, more degree of freedom and more efficiency (Chamberlin, 1984). Time series data are better suited to study the dynamics of change (Gujarati, 2006). Historical data were collected in cycles of the poultry agribusiness financial statement, financial risk, prices of inputs and outputs, bank interest rates, inflation rates, exchange rates and bank lending rates.

Data Analysis Techniques

Estimation of Poultry Agribusiness Risk

Financial risk was determined by computing the mean risk level for each year and then determining the standard deviation of financial risk over the six-year period. Hence standard deviation was used as the poultry agribusiness risk estimator. An a posteriori approach to risk estimation was adopted. It involves the statistical estimation of risk

parameter on the basis of past data. The risk estimator (Historical standard deviation of profit) was achieved by first of all determining the historical variance as:

$$\sigma\pi_t^2 = \frac{\sum_{j=1}^{n} (\pi_{tj} - \mu)^2}{n} \quad \text{(Equation 1)}$$

Where:
σЛt^2 = Historical variance of net return
Лtj^2 = Net return of the jth year
μ = Mean net return
n = number of years

The square root of historical variance was used as the historical standard deviation as follows:

$$SD\pi_t = \sqrt{\frac{\sum_{j=1}^{n} (\pi_{tj} - \mu)^2}{n}} \quad \text{(Equation 2)}$$

Where:
$SD_{Лt}$ = Historical standard deviation of net return

In the past, there was robust debate among statisticians about the relative merits of measures of dispersion as risk estimator. Sample standard deviation won universal appeal because of its efficiency for normally distributed data (Ederington and Guan, 2000). To that extent, historical standard deviation of return was chosen and used as the poultry agribusiness risk estimator in this study. Rate of return on investment was used as the estimate of financial fragility of poultry agribusiness in the study. The difference between rate of return on investment and bank interest rate was used as a measure of financial fragility in poultry agribusiness in this study. The financial fragility of poultry agribusiness was therefore evaluated by the statistical difference between rate of return on investment of poultry agribusiness and the prevailing interest rate.

Evaluation of Macroeconomic Shocks Variables

Regarding the income shock variable, the plans of economic agents are based on the current state of affairs, the economic outlook and expectations. The expectations affect the agents' investment plans. Macroeconomic shocks tend to cause deviations from these investment plans. Although economic agents may try to adjust their actions and plans accordingly, the negative effects of a shock can be seen in the number of agribusiness failures through income loss and unemployment.

There is the need for deriving theoretically the optimal function for expected income. The underlying assumption is that the optimal or forecast values have a strong expectations generating effect known as shock or surprise. Thus
MS = Yp - Yp^C

Where:
MS = macroeconomic shocks
Yp = Expected value of macroeconomic variable
Yp^C = Actual value of means economic variable.

The direction of the effect depends on whether the change in price is due to demand pull or cost push. We assume that negative income surprises lead to losses at any given level of fragility.

Interest rate is another crucial variable which directly affects the profitability of poultry agribusiness investment. The effect is direct if the project is financed by borrowed money, otherwise, the effect is indirect through the so called opportunity cost effect. The nominal interest rate tends to correlate with inflation like income variable. It is reasonable to use real interest rate. There is also some evidence that a surprise in the price component from the past period t_{-1} contributes to a change in the current period price expectations.

It is important to understand how macroeconomic distortions affect financial losses in the poultry agribusiness and how resilient is poultry agribusiness under adverse macroeconomic scenarios. An unexpected shock is the difference between realized and expected outcome. The study assumes that probability of profit short fall (risk) is a product of macroeconomic shocks and financial fragility.

Probability of profit loss = (macroeconomic shocks × financial fragility)

The lower the rate of return on investment the more financially fragile the poultry agribusiness and vice versa. This makes the effect of macro-economic shock to be more or less pronounced on poultry agribusiness risk.

This study made an assumption that financial risk ($SD_{Лt}$) in poultry agribusiness is a function of the product of financial fragility and some macroeconomic distortions (interest rate, exchange rates and inflation rates). This causality relationship was fitted into a multiple regression model.

The model is implicitly stated as:

$$SD_{Лt} = f(FFG)\ (\sum \beta_i xi) + \mu \quad \text{(equation 3)}$$

Where:
$SD_{Лt}$ = Poultry agribusiness risk
F = function
FFG = Financial fragility
β I = Vector of ith macroeconomic shock variable
xi = Macroeconomic shock variables
μ = Error term

The model is explicitly fitted as:

$$SD_{JIt} = (\beta_0 + \beta_1 INT_{t-1} + \beta_2 REXCH_{t-1} + \beta_3 INF_{t-1})(FFG) + \mu_t \quad (4)$$

Where:

SD_{JIt} = Poultry Agribusiness financial risk
INT = Interest rate (%)
REXCH = Real Exchange Rate (%)
INF = Inflation rate (%)
μ = White noise

The Statistical Package of Social Sciences (SPSS®), Version 17 was used to analyze the model. Three functional forms were estimated namely, linear semi log and double log functions. The linear function was chosen as the lead model on the basis of R^2 value, F – statistics and number of significant variables in the model.

RESULTS

Financial Fragility in Poultry Agribusiness

The result shows that the optimal in poultry agribusiness risk is 15%.

A Test of Financial Fragility (resilience) in Poultry Agribusiness

H_o: *There is no significant difference between rate of return on investment in broiler enterprise and bank interest rate*.

This hypothesis was tested with the use of t-statistics as shown in Table 1:

Table 1 shows the test of significant difference between mean rate of return on investment in poultry agribusiness and the mean interest rate for the period of the study. The result showed that $t_{calculated\ (2.14)}$ is greater than $t_{critical\ (1.96)}$ ($P < 05$). As a result the null hypothesis is rejected and the alternative accepted that historical mean rate of return on investment in poultry agribusiness (58.25%) is significantly higher than the historical mean rate of interest (17.19%) charged by banks by 41.06% within the period of the study (2004-2009). This finding implies that the balance of 41.06% rate of return on investment in poultry agribusiness is substantial enough to finance consumption expenditure and for expansion of the business. This further implies that poultry agribusiness resilient is resilient and hence the shock-bearing capacity is relatively high. Lending institutions should not exercise fear of repayment default provided farm owners have the willingness to pay their loans. Financial institutions are often doubtful on the financial fragility of agricultural ventures. This finding has proved that poultry agribusiness in Nigeria has the capacity to offset borrowed fund. The industry ability to perform credit obligation is enhanced by the reason of the surplus rate of return on investment. This finding is in agreement with the earlier report of previous authors. Samuelson and Nordhaus (2001) demonstrated that the positive difference between interest rate and rate of returns of an industry is a measure of its financial fragility. CBN (2008) has earlier maintained that financial fragility of an industry should be evaluated within the context of opportunity cost of investment. Interest is the cost of investment. Financial wealth arising from substantial returns would enables poultry producers to command more productive assets with subsequent expansion of the industry.

Resilience of Poultry Agribusiness to Macroeconomic Shocks

The resilience of poultry agribusiness to macroeconomics shocks was evaluated through trend rate of return on investment ($RROI_{t-1}$). The emanating trend correlation equation is presented equation 5.

$$SD_{IIt} = \mathbf{1.0023} - \mathbf{0.008RROI} + \mu_t \quad (5)$$
$$(1.2645) \quad (-13.52)^*$$

The figures in parenthesis below the coefficient are the corresponding t-values. It is shown in the equation that trend poultry agribusiness risk is negatively and significantly correlated ($P < 0.05$) with trend rate of return ($RROI_{t-1}$). This result shows that rate of return has the tendency to reduce the impact of macroeconomic shocks on poultry agribusiness. In other words a high rate of return on investment gives the poultry agribusiness an internal resilience against external shocks.

Table 1: T-test of Significant Difference between mean rate of returns on Investment and Mean interest Rate

Variables	Mean	variance	df	t-stat
Rate of Returns on Investment	58.25	0.025	15	2.14
Bank Interest Rate	17.19	0.905	15	

(Source: Field Data 2009)

Table 2: Macroeconomic Variable that affect Financial Risk in Poultry Agribusiness

Variables	Coefficients	Standard Error	t-stat.
Intercept		1.0023	0.7927
1.2645			
Interest Rate	0.1218	0.0568	2.1439 **
Inflation Rate	0.0039	0.0014	2.7281 ***
Real Exchange Rate	0.0074	0.0035	2.1044 **

(Source: Field Data 2009)

R^2 = 98%; R^2(adj.) = 94%; F – stat. = 69.84; *** = significant at 1%; ** = significant at 5%

Impact of Macroeconomic Shocks on Poultry Agribusiness Risk

The result of the causality between financial risk and macroeconomic distortions is shown in Table 2.

The joint impact of macroeconomic shocks variables; interest rate, inflation rate and real exchange rate; on poultry agribusiness risk was evaluated using the emerging values of R^2 (98%) and F-statistics (69.84) in the model. The R^2 value of 98% implies that about 98% of variation in poultry agribusiness risk is explained by macroeconomic distortions (exogenous variables) in the model. With this result, the null hypothesis of no significant impact, is rejected and the alternative accepted, that macroeconomic shocks have significant impact on the financial risk in poultry agribusiness in Nigeria. The F- ratio was adopted to test the overall significance of the model. F-calculated value (68.84) is greater than F- critical value of 2.76. This indicates that the model is generally significant, reliable and relevant for economic policy formulation in Nigeria.

The causality equation is presented as

$$SD_{Дt} = 1.0023 + 0.1218INT + 0.0039INF + 0.0074\,REXCH + \mu \quad (6)$$
$$(1.2645)\quad (2.1439)^{**}\quad (2.7281)^{***}\quad (2.1044)^{**}$$

The value in parenthesis, are the corresponding t – values.

Where: $SD_{Дt}$ = Financial risk (poultry agribusiness risk)
INT = Interest rate
INF = Inflation rates
REXCH = Real Exchange rate
μ = Error term
** = Significant at 5%
*** = Significant at 1%
R^2 = 98%

Interest Rate

This variable was significant and entered the model in line with a priori expectation of positive relationship with poultry agribusiness risk. This implies that financial risk in the poultry industry is sensitive to interest rate in the economy. A high interest rate would lead to high financial risk. This is because high interest rate would increase costs of capital and cost of production. Borrowers would use significant part of return to service interest. This would subsequently reduce net return. Fluctuations in interest rate would correspondingly lead to fluctuations in returns on investment in the broiler industry over time. This can adversely affect capital supply to the industry. High interest rate can impede broiler farm firm's ability to perform credit obligation thereby leading to loan default. Interest rate can be viewed in the context of other adverse costs associated with non-performing assets. Interest rate is a crucial variable which directly affects the profitability of an investment project. The effect is direct if the project is financed by borrowed money, or otherwise, the effect is indirect through the opportunity cost effect. This finding agrees with the report of CBN (2008) that interest rate is one of the key risk factors in financial market environment that can significantly affect the financial risk of a firm. Within the context of earning perspective, fluctuations in interest rate could create an adverse impact on reported earnings of the poultry agribusiness.

Inflation Rate

This variable entered the model with a positive sign in line with a priori expectation. This variable was significant with a gradient of 0.0039. The positive relationship between financial risk and inflation rate as evident in the study indicated that an increasing inflation rate would translate to increased risk in poultry agribusiness all other factors being constant. Fluctuating inflation rate is a reflection of unstable cost of factors of production in the poultry agribusiness. In Nigeria, the unstable prices of petroleum products can substantially increase inflation rate. This can further translate to unstable prices of inputs and outputs of poultry agribusiness. This will further translate to unsteady profit to poultry entrepreneurs. This finding supports the

earlier assertion of Lucey (2002) that changes in the prices of factors of production such as wage rates, sales, prices, transportation, due to inflation should be an important factor in investment analysis. Robert (2000) also stressed that high inflation rate could wipe off the profit realized in the period of business boom. Government policies on price control in Nigeria may substantially diminish effect of inflation rate on financial risk in poultry agribusiness.

Exchange Rate

This variable was significant and entered the model with a positive sign in line with a prior expectation. A positive relationship between exchange rate and financial risk in the poultry enterprise was observed. CBN (2008) referred to exchange rate variation as exchange rate risk. Adverse fluctuation of foreign exchange rate could impact negatively on capital and revenue.

DISCUSSION

Financial disturbances can be costly in poultry agribusiness management. In particular, systemic shocks often affect the poultry agribusiness in a deeply traumatizing way. The result of this study has accentuated the importance of anticipating the risks of such adverse development so as to mitigate financial catastrophe and ensure financial stability. Modeling the probability of financial losses with respect to overall macroeconomic shocks has demarcated the effects of individual macroeconomic shock variables on agribusiness risk accordingly.

The effect of a shock is either absorbed or amplified by the prevailing fragility. The failure of a number of poultry agribusinesses can be the joint effect of shocks and fragility. This is because the vulnerability to financial crises depends on its economic performance in terms of financial fragility.

Drawing from the above result, the macroeconomic shock variables are considered to be among the common factors underpinning overall poultry agribusiness profit short falls. In the same vein fragility variable represent the overall poultry agribusiness financial strength. A macroeconomic shock is constructed as a surprise relative to expectation where the average or published macroeconomic variable forecast, represents the expected development. Others have modeled shocks as trend deviations or as mere changes that occur in macroeconomic variables (Bikker and Metzemakers, 2004). In this study, of all the macroeconomic shock variables, factor analysis indicates that interest rate and inflation rate are the most significant macroeconomic shock variables that impact on agribusiness risk in Nigeria.

Fine-turning of factors such as interest rate, inflation rate, lending rate, exchange rate, among others can lead to economic growth. There should be marketing information on poultry input and output prices published in the Nigerian dailies. Macroeconomic policy that will benefit the poultry sector should put into consideration the ominous effect of interest rate, exchange rate and inflation rate on financial risk in domestic business such as the poultry business. Accordingly, government should stabilize petroleum product prices. Data based on these indicators have been used in numerous economic crises studies as explanatory variables, as shown in the earlier works of (IMF, 2000; Demirguc-Kunt and Detragiache, 2005).

In conclusion: The empirical results of our survey lead to the following conclusions. First, there is a close link between macroeconomic shocks and the financial stance of poultry agribusiness. Secondly, inflation rate seems to exert more influential on the development of poultry agribusiness. Thirdly, while also interest rate and exchange rate shocks have a significant impact on the poultry agribusiness risk, the evidence is mixed for interest rate stocks. There is strong link between micro and macro variables. The study has explicitly implied that inflation rate shocks, interest rate shocks and exchange rate shocks are all price-related shocks in the economy; liquidity derived from profitability operates from within the poultry to counter financial fragility. It provides internal resistance/resilience against external shocks in the economy.

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