Innovative Journal of Medical and Health Science
Received 20 August 2022|Revised 05 August 2022 | Accepted 30 Sept 2022 | Published Online 05 October2022

Inno J of Med Health Sci 12 (10), 1984-1993 (2022)

RESEARCH ARTICLE

ISSN (P) 2589-9341 | (O) 2277-4939 IF:1.6

Influence of Price Fluctuation on Coffee Production in Rwanda (2009-2019)

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Abstract

Coffee market prices have been unstable over time. Determining the impact of supply and demand shift on price is a subject of discussion in this research journal. In order to enhance investment and achieve a sustained increase in agriculture production especially coffee, coherent and integrated long-term strategies and policies are required to reduce risk aversion and build resilience in Rwandan farmers as well as its economy. Furthermore, the critical importance of social protection and its complementarities to risk management initiatives must be recognised. This journal focuses on influence on price fluctuation on coffee production in Rwanda. The objective of this research journal is to analyse the influence on price fluctuation on coffee production in Rwanda using data collected from RAB starting from 2009 to 2019. The researcher employed statistical and econometrics approach to estimate the annual shifts in demand and supply for the periods from 2009 to 2019. This approach gave estimates to change in demand and supply of a coffee commodity which is due to other factors apart from the coffee's own price. The research design is based on the quantitative research based on econometrics models under study, the data collected from public publications such as NISR, RAB, MINAGRI, CIA, WORLD BANK. The temperature and rain had a significant influence on coffee production. This is explained by the coefficient of temperature and rain are 0.329 and 0.48, it implies that 32.9% of temperature contributed positively to production and it increased by 32.9% by one percent of production and its probability of less than 5% thus, it is statistically significant and contribute to production positively, thus positive relationship. The Demand shift had a significant influence on coffee production. This is explained by the coefficients demand shift is -0.40 which implies that demand shift decreased by 40% to one percent of production and its probability of 0.085 to 96.9% this implies that demand shift decreased by 40% on one unit of production. Demand shift had a significant influence on coffee production. Supply shift on coffee production contributed to 97.2% to coffee production and its probability less than 5%, it implies that 97.2% of supply shift increased to one percent of coffee production. Finally the intervening variables, one is the exports which contributed positively to production since it increased by 13.2% on one percent of Production and also the probability is 17.5% less than 5%, thus there was weak relationship between export and production ,import, its coefficient is 0.48 which implies that it increased by 48% on one percent of production and its probability of 0.03, there is a positive relationship and government subsidies such as fertilizers used was 0.842 which implies that there was a strong relationship between fertilizers used and coffee production, its probability of less than 5%.Thus it implies the fertilizers increased by 84.2% by one percent of production. The researcher concludes that weather, supply have positive contribution while demand has a negative contribution and recommends that the government should concentrate on the macroeconomic framework that aims strengthen the agriculture sector through increase of demand and supply of agriculture products to increase the internal market through exports. As well as strengthening the foreign cooperation to deal with climate change so that the rain and temperature can be the solution for Rwandan agriculture and focus on the subsidy since the findings reveal that they influence the agriculture production.

Key words: Coffee production, demand shift, supply shift, price fluctuation

1 | INTRODUCTION

This research journal focuses on influence of price fluctuation on coffee production in Rwanda, it aimed to analyse the contribution of the factors which cause price fluctuation in Rwanda and shows which factors have more influence on price fluctuation. By 2050 vision, the estimates say that the global population will have reached 9 billion people, while farmlands decrease and food demand increases (UN, 2017). Smallholder farmers contribute to about 70% of the food produced globally, yet they often remain in poverty and face problems of food insecurity (FAO, 2018). Price fluctuation on agricultural production is not a preserve of one country or a specific economy but rather an occurrence that has engulfed a number of countries around the globe. Several countries both in the developed and developing world are grappling with agricultural price fluctuations that are caused by factors that are sometimes beyond the control of these countries. World agriculture production continues to face challenges along with other existing forces, pose risks for poor people's livelihoods and food security. Land is now in demand, not only to produce food and to provide shelter and comfort for the world's population, but also in significant quantities for production of energy in various ways. The arguments presented in this study suggest that in response to the lessons learned from the latest period of spectacular price volatility in the world food market, policy initiatives in three areas are justified such as comprehensive and above all sustainable social protection and food and nutrition initiatives to meet the short and medium -term needs of the poor and to serve as the basis for emergency response channels in times of food crises.

Throughout most of the twentieth century, the inelastic demand for agricultural commodities, combined with growing productivity, helped depress agricultural prices (Cochrane 1993). Beginning in the 1930s, US agricultural sector policies focused on controlling supplies of programme commodities in order to increase market prices and, ultimately, net farm income. Over the years, this governmental effort to relieve the pressures of excess supply generated a host of unintended consequences such as periods of large public stockholding, over-allocation of variable input resources, and depressing effects on world food commodity prices.

The US government also attempted to expand food demand, via the foreign food aid programme, the domestic food stamp programme, export subsidies, and the USDA's Foreign Agricultural Service export enhancement programmes.

The voluntary nature of the governmental programmes allowed participants to gain access to governmental subsidies so long as various supply control mechanisms such as crop acreage-base restrictions, annual acreage-idling programmes, and conservation programmes were honoured.

In the current century, the United States and the world has shifted from chronic excess supply due to greater growth in farm productivity than in demand to chronic excess supply due to greater growth in farm productivity than in demand to chronic excess agricultural productivity and rising increases in farm commodity demand from China and from energy producers precipitated a complementary shift in US farm commodity policy from suppressing to stimulating supply of farm output. Moreover, the United States' agricultural sector has become, on average, more prosperous relative to the rest of the economy, so that the distributional justification for many agricultural policies in the United States has ceased to exist (Gardner 1992).In Europe, A sharp increase in the price of food affects the poor to a much greater extent than a similar increase in the price of other goods because food forms a much larger share of their total purchases. Faced with an increase in the price of staples, poor households will respond by substituting away from other items in their consumption basket. A common policy response to this situation is to subsidize the price paid by consumers, either through a general subsidy or a more narrowly targeted programme. General subsidies are less efficient than targeted ones, and can also reduce producer incentives by lowering prices. They may also be accompanied by a greater fiscal strain than a targeted programme. However, targeted subsidy programmes require time and money to set up and administer, and a blanket subsidy may be an appropriate short term response with a limited time mandate.

Frequent fluctuations in food prices are not conducive to farmers forming stable food price expectations; thus, farmers cannot use food prices to make a reasonable grain production plan for the next year. In addition, a rise in food prices causes other commodity prices to rise, which leads to inflation and is not conducive to China's economic stability. When the price of agricultural products rises, the stabilization of prices will become a key concern of the government. The government will often take measures to suppress this process. However, when the prices of agricultural products fall, the lack of policy assistance measures will often come at the expense of the interests of farmers, seriously damaging the enthusiasm of farmers (Liu&Li, 2010). Once farmers' production incentives are diminished,

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the effective supply of food is difficult to protect. The pricing of agricultural products is an important part of China's macro-control policies for economic development, and the implementation of such policies has a very important role in the supply and demand of agricultural products in China. Food pricing also has a crucial impact on China's economic development and the welfare of farmers. Frequent fluctuations in food prices will make it difficult for the government to implement effective macro-control measures for the grain market.

For Africa, Agricultural production is prone to several risks which affect both producers and consumers. In order to enhance investment and achieve a sustained increase in production, coherent and integrated long-term strategies and policies are required to reduce risk aversion and build resilience among African rural producers. Production risks are highly interrelated with price and market risks. This means that the variability in production can result in high food price instability; the less the markets are integrated with each other, the higher the price instability stemming from variability in local production. By contrast, in poorly integrated markets, production shortages result in higher prices that may compensate producers from production losses but, at the same time, negatively affect consumers (Y. Rashid &Jayne 2010).

Agricultural production in Rwanda is greatly base on rain seasons, different crops are affected by different problems like climatic condition and diseases, and these lead to fluctuations in product supply, this changes lead to change of agricultural prices. Agricultural products prices fluctuate relatively more than those of manufactured product, in other words instability of agricultural product prices is greater than price of manufacture goods.

Price fluctuation of agricultural product is known as upward and downward movements which are irregular, or movement or changes in prices of agricultural commodities in a given market place. Price fluctuation is a complex problem qualified by various factors which result many consequences on different parties such as government, producers, farmers and consumers. The high price is good news for farmers and bad for consumers.

Price fluctuation is dangerous for producer as consumers. The main reason of price fluctuation is the level of supply and demand. The specific focus is to identify the contribution of the factors which causes price fluctuation for agricultural products, by using secondary data we analyse the contribution s of the cause of price fluctuation of agricultural product in Rwanda and analyse the short- run and long run effect on agricultural production in general. This study shows the effect of price fluctuation of agricultural production in Rwanda. By using different factors like, agricultural production, quantity demand, quantity supplied, Temperature, rain fall, level of openness of the country and government subsidies; the researcher is able to find the contribution of each variable for find the cause of price fluctuation in Rwanda for agricultural product and proposed different solution. Rwandan Agricultural product price increase and causes a shift of consuming the foreign product as substitute product and cause the government to import more and government expenditure on agricultural product to cause the increase. Thus, the farmers will not be encouraged by producing that product. Therefore, the researcher seeks to investigate the effect of price fluctuation on agricultural production using data collected from 2009 to 2019 to fill different gaps emerged from this study.

2 | PROBLEM STATEMENT

The stability of prices is very important in ensuring that inflation and deflation are effectively managed within any economy. It also ensures that different sectors in an economy can enjoy predictable prices of commodities. However, price fluctuations are common in business as a result of changes in demand and supply (Frankfurt and Main, 2009). The issue of price fluctuation shows a critical importance today in the context of agricultural trading products. One of the major arguments advanced against agricultural trading products is that it would lead to transmission of international price fluctuation into domestic markets. When the price is high particularly in food commodities, it affects poor agricultural labourers and labour engaged in unorganised sector adversely because their wages are not index-linked. Small farmers in developing countries with low propensity to save and poor access to efficient saving instruments cannot cope with the revenue variability resulting from fluctuations in output prices. They do not possess the requisite know how for crop diversification and also lack access to appropriate technology. Commodity price fluctuation poses problems also for the governments and exporters of the primary commodity-producing developing countries (Sekhar, 2013). Agricultural products show serious price fluctuations both in Rwanda and among developing countries.

Fluctuations of agricultural product are in line with the cobweb theory. It means that the increase of agricultural product based on the previous prices, and the produces set prices basing on the last prices. This also may cause price instability of agricultural product in Rwanda (Karsan and Gul, 2017). Price fluctuations have also been experienced in Rwanda and its effect has been felt in a number of other economic sectors. This effect has revealed different findings accordingly. A study by Ghosh (2009) on the determinants of agricultural prices in India revealed that the quality of agriculture products played a very significant role in determining the fluctuations. Mustapha and Culas (2013) also conducted a study on price fluctuation causes, contribution and consequences of price variability in agricultural commodity market in Africa. The study established that lack of sustainable farming practices was the main cause of this problem. According to Kibaara (2008) conducted a study on trends in Kenya agriculture and established that agricultural productivity has been growing at a slower rate. The studies mentioned above find the evidence of research on agriculture but the available studies have mainly focused on the determinants of agricultural price fluctuations on agriculture production. Despite that the studies above are addressed by the researcher, different findings were found. Thus, different gaps in terms of methodologies, concepts and this needs to be filled and therefore this research study seeks to investigate this existing gap by investing the effect of price fluctuation on agriculture production in Rwanda using data collected from NISR from 2009 to 2019.

3 | OBJECTIVES

The general objective of this research journal is to analyse the influence of price fluctuation on coffee production in Rwanda using datafrom 2009 to 2019 while the specific objectives of this research journal is to analyse the impact of weather condition on agriculture production and analyse the impact of demand shift on coffee production

4 | LITERATURE REVIEW

This part looks at different variables that assesses the influence of price fluctuation on agriculture production in Rwanda, from 2009 to 2019 from the side of previous studies and researchers. It startes with theoretical framework, empirical review, the concept framework and the research gap.(Poudel &Kotani ,2013), he tested the weather change and agriculture production using Production function, in his empirical evidence he found a significant relationship between weather change and agriculture production. Thus, the climate variation and changes can have significant impacts on agricultural production, forcing farmers to adopt new practices in response to altered conditions. Higher temperature, changes in precipitation, and increased climate variability can affect agriculture, forestry, and rural areas.

(Adejuwon&S.A,2004), on his empirical review, he used Crop simulation model using weather condition and crop productivity in Nigerian economy, thus there is Weather annual fluctuation which significantly affect the agriculture production., thus he revealed that the lowest agricultural production was observed Nigeria experience a sharp increase in foreign earnings as a result of increased oil revenue. Increments observed after a period can be likened to government policies aimed at improving agriculture in Nigeria. A sharp drop was also experienced in the year 2001, which may be due to climatic factors, changes in political views, and unrest observed in some parts of the country.

(Mendelsohn, Ariel & Arne, 2000; CICERO, 2000), he argued that the degree of the impact of the climate change and its distribution is still debated on the current evidence of high temperatures and low rainfall suggests that countries in temperate locations may benefit from small economic advantages because additional warming will increase their agricultural production.

Villesca& Shumway (1992), on their empirical evidence, using the demand theory, they stated that the prices of agricultural products have a strong influence on stability. They did it on 25 individual crop and livestock output supplies and 6 input demands in the US, the results showed that the own-price input demand elasticity were also generally inelastic.

(Andreyeva et al., 2010), on their empirical evidence, he analysed the price elasticity of demand through review of 160 relevant studies, they came up with the data showing that the coefficient of elasticity of fruit, poultry, milk, vegetables and eggs is less than zero, thus they revealed that the prices having no significant impact on the elasticity of this market, the presence and influence of other factors that affect the elasticity of demand reinforce the inelasticity of this market.

(Hualin and Bohao,2017),on their empirical evidence, they tested the empirical analysis of the effect of price fluctuations using China' s Grain Yield, they find that there is a long- term equilibrium co- integration relationship between them. He observe Granger relationship between price fluctuation on agriculture production and grain yield, he shows that agricultural prices on food production have different problems such as market supply and demand intensification, and many food policies were farmers did not provide incentives. Reduce the cost of grain to protect the interests of farmers, strengthen the protection of arable land on an agricultural scale as solution is to strengthen the agricultural market information channel construction and complete the collection of agricultural product prices for analysis and issue.

(Hasan Arisoy, 2017) in his study, he analysed the determination of the effect of price fluctuations on producer income using a case of potatoes, his results findings revealed that price fluctuation in potato prices has relatively a rapid effect on production, and produce income determined by annual potato price. In his study he shows that price of agricultural products is affected by some.

(Guohua Gou, 2017), on his empirical evidence on Relationship between agricultural product price fluctuation and inflation, by using inflation expectations and inflation in China January 2011 and November 2015.His results findings revealed that agricultural product, price fluctuation, inflation and inflation expectation did not have any long term relationship but find the existence of granger causality between them. Using the impulse responses the result showed that the inflation expectation and the fluctuation of inflation have a lag in the transmission of the agricultural price fluctuation, and their transmission effect with time to strengthen, agricultural price fluctuations on inflation expectations is not very significant.

(Happiness Huka; Cecilia Ruoja;AlbanMchopa, 2014**),** on their empirical review, their study were based on price fluctuation of agricultural Products and its impact on Small Scale Farmers Development, their findings revealed that development of small scale farmers depend complete on the

price stability of their farm produce, the study shows different reasons of price fluctuation of agricultural product such as change in climatic condition, government regulation, poor infrastructures, seasonal production, fluctuation of currency exchange rate, nature of product as well as low production and storage technology.

(Li Zhong Bin, 2013) in his study, he analysed the farmers' production behaviour using the causes of price fluctuations of agricultural products. His results findings revealed that as necessities, agricultural products itself was the cause for fluctuation and the expectation for agricultural products price commended the farmers, consumers and speculators. His results findings also showed that speculation in store the agricultural product improved the volatile prices of agricultural product.

(Frankel, 2013),in his study, he tested the price fluctuation and other variables that intervene in agriculture production, He further argues that international price fluctuations are mostly affected by macro variables that are difficult to ignore in any given economy. When there are significant price fluctuations in international commodity prices, even the local prices will also experience notable fluctuations.

Wolf (2008),there has been serious fluctuation in international commodity prices due to economic growth changes that are being experienced in some countries such as China. The demand for cheaper products from countries that have experienced growth in production has had an effect of fluctuations in a number of countries. The high growth experienced in countries such as China after the 2008 economic recession has greatly influenced international commodity price fluctuations in many countries.

(Erdal, 2006; Ozcelik&Ozer, 2006).On their empirical review, they used the technological changes in the production of agricultural products where land is the dependent variable to test whether they have the effect yield. Their findings revealed that changes in production quantities are affected by a combination of technology, price and public politics and the natural factors are normally uncontrolled, but factors that affect the yield can be partially controlled.

(UNCTAD, 2002),the volatility on international commodity prices has also been caused by increasing production in some countries around the globe. The increased production has also led to a decrease in the prices of some commodities and this puts commodity dependent countries or firms at a highly vulnerable situation. Firms that depend on income from agricultural commodities are therefore likely to suffer frequent financial shocks as a result of the high price volatility in the international market due to high production

Wu. H.X (2014), he made the study on food prices and food production, the supply and demand point of view to research food production problems. He also use the supply reaction model to study the relationship between grain prices and yield, and some research is based on the price of a single grain variety, but there is a lack of empirical research on agricultural prices for food production. Therefore, based on the data of agricultural product prices and grain yield in the past 30 years product price and grain yield by using a VAR model and Granger causality test on the basis of descriptive analysis of agricultural product price and grain yield. Based on the relevant results, thus he revealed that there is a positive correlation between the quantity supplied and the production.

4.2Theoretical framework:

There are a number of theories that explain the concept of price fluctuations in relation to agriculture production. This study will be based on different concepts, theories and models

Theory of diffusion:

According to Cardno (2017), this model aims at using technology to improve the agriculture production. It is thus the aggregate measure on how technology is spread to the farmers to make the agriculture more productive mostly using different varieties of land and labours in different regions that are more fertile. It provides much more research and it was developed emphasizing the relationship between diffusion rates and the personality, characteristics and educational accomplishments of farm operators. This model provides the major intellectual foundation of much of the research and it remains incomplete as a theory of agricultural development. The agriculture development through this model is based on dissemination of effective technical skills to improve the agriculture production and this model was utilised even before since it was associated with crop exploration and the findings from different researchers showed a significant impact on agriculture productivity.

Cobweb theory on price fluctuation and agriculture production:

The cobweb theory is a dynamic analysis theory that uses the elasticity principle to explain the different fluctuations in some commodities with long production periods when they lose balance. The basic assumption of the cobweb theory is that the current production of the commodity is determined by the price in the previous period. According to the assumptions of the cobweb model, farmers will determine the current grain-sown area according to the price of the previous period before the grain production is carried out. Then, the current grain price will have determined the grain yield of the next period to a certain extent. Thus, in the food supply and demand model, the impact of price changes on the supply of food will be substantial. The higher the price of agricultural products, the stronger the enthusiasm of farmers and the food production will increase. In contrast, lower prices of agricultural products will dampen the enthusiasm of farmers to increase grain production so that farmers will reduce the next year's planting plan, which will lead to a reduction of that year. Through the analysis of the price transmission mechanism of agricultural products, we can find the interaction effect and transmission effect of each link in the industrial chain, adjust the reasonable distribution of the stakeholders of each link, maintain the income level of the agricultural producers and the living standard of the consumers, stabilize the agricultural market price, and achieve a smooth transition in socio-economic transformation. As the most effective means of agricultural market regulation mechanism, the price of agricultural products plays an important role in regulating production and consumption (Han& X.L, 2007).Agricultural production is greatly affected by climatic conditions and the impact of pests and diseases, both of which lead to fluctuations in product supply. Accordingly, while prices are low in years with a high yield, in years where there is a low yield prices are much higher (Sarkar, 1992; Caliskan et al., 2010). In addition to all of these factors, agriculture producers are unable to conduct proper production planning and establish effective marketing organizations due to their low level of education. Organisations due to their low level of education and the small scale of the enterprises involved also increases price uncertainties (Erdal and Erdal, 2008).

The Urban-Industrial Impact Model on agriculture:

This model is based on geographical factors on agriculture development, through the location variations in agricultural development were related primarily to differences in environment factors,it is explained by the rate of urban

industries to explain how farming is done and how factors of production contribute in the industrialized economies .According to Cardno (2017),the expansion of the model explains the effectiveness of the agriculture production due to product market linkage in economies whose the level of urban -industry development is achieved.The model has been tested extensively in the limited states but has received only limited attention in the less developed world. Therefore, this model of agricultural development evolved from the advances in crop and livestock associated extension effort in farm management and its production.

4.3 Conceptual framework:

In this research journal, the researcher analyses the influence of price fluctuation on agricultural production. This is explained by the diagram that depicts the interrelationship of the stated variables. The dependent variable of this research journal is the agricultural production while the independent variables are the price fluctuation components. Those components are weather condition, inelastic demand, inelastic supply, the researcher considers temperature for representing weather condition because is one of the crucial for defining the weather condition.

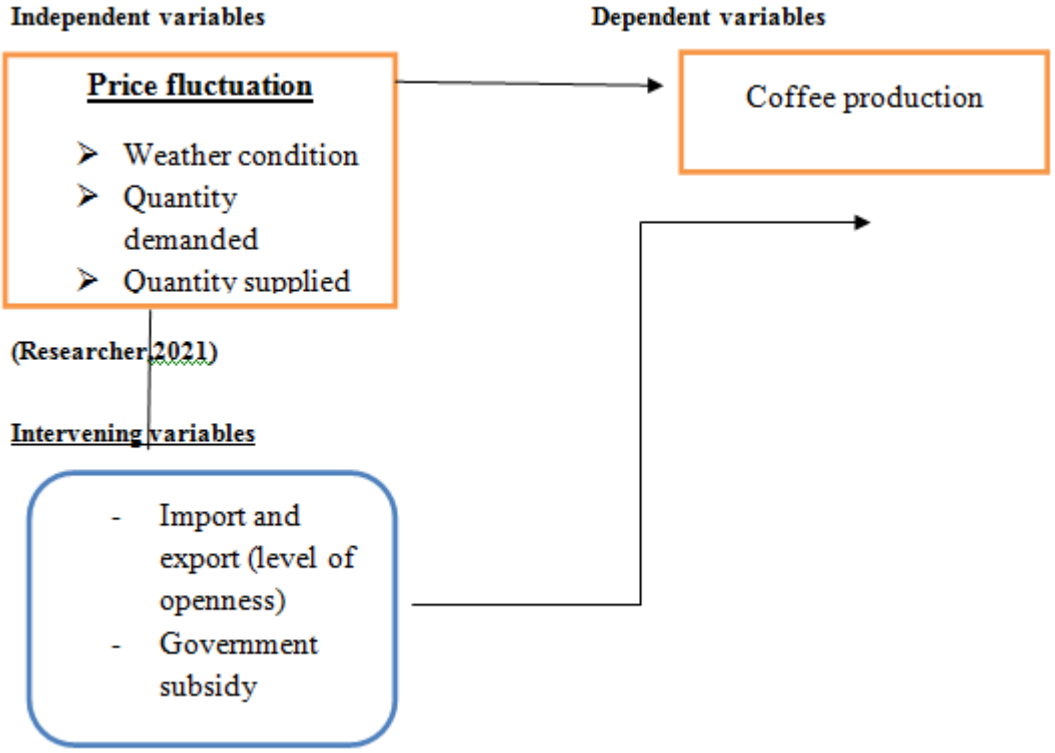

Figure 1: Concept framework

The diagram shows the relationship between the stated variables, the weather condition on coffee production, there is a correlation between weather condition and coffee production, there is a correlation between quantity demanded and coffee production, between quantity supplied and its production and also the factors that are not mentioned in the model, those factors are the level of openness, government intervention. In international market if quantity of good exported is greater than the quantity of good imported it means that in the country we have surplus of goods and services but if import is greater than export means that we have shortage of goods and services. This level of export and import will contribute on domestic price if we import more; price may change positively or negatively, if export increase price of good at domestic level will change basically on the quantity of goods exported. The mentioned variables have appositive or negative relationship. So all of those variables contribute to coffee production and thus the results findings will allow the researcher weather there is a negative or positive correlation among them.Many studies have been conducted on fluctuations in agricultural product prices. Different econometric models have been used in these studies to investigate the price fluctuation in agricultural products. For example, Yurdakul (1998), Bayaner et al. (1999), Dikmen (2005), Erdal (2006), Ozcelik and Ozer (2006) use the Koyck model, while FidanveKoc (2001) use a spatial equilibrium model. By contrast Marongiu (2005) uses a simultaneous equations econometric model, Pavlista and Feuz (2005) use a linear regression model, as does Ucak (2012), Sahinli and Ozcelik (2016) use an almon model, Ozer and Ilkdogan (2013) use box jenkins model. Some studies use a number of models, for example, Biscaro and Liviero (2012) use a combination of simultaneous equation model, multilayer perceptron model, and the autoregressive integrated moving average model. But remaining is to show the contribution of the factors which affect price fluctuation. The implication is to know the factors which influence agricultural production, in this sector among of the factors which affect demand and supply; it means that we do not know the contribution of each variable for price changes. Price of agricultural product is unstable government and consumer even produce need to know how agricultural product prices can be stable, for knowing this we should analyse the contribution and contribution of each variables which affect price to change day to day and we find the solution of the problem of instability of price fluctuation of agriculture product. All studies didn't show the factors which influence more agricultural production and shows the effect of price on agricultural production.

5 | RESEARCH METHODOLOGY

5.1 Research Design:

This research journal is based on quantitative research approach aiming at the influence of price fluctuation on coffeeproduction in Rwanda using annual data collected from 2009 to 2019. The information is to be collected in

different publications, specifically in Rwanda National Institute (NISR) of Statistic related to agricultural production.

5.2 Model Specification:

In an attempt to find the influence of price fluctuation of coffee production in Rwanda based on data collected from 2009 to 2019. The regression analysis is also employed in this analysis. The model states that coffee production depends on whether condition, producers, supply and other factors that are not mentioned in the model

The model was specified as follows

Y=α0+α1WEA+α2DEM+α3SUP+Ut

Where α0 is the constant α1 to α3 are the coefficients

Y: is the coffee production
WEA: is the weather condition
DEM: Demand (change in demand)
SUP: Supply (change in supply)
: erroterm

5.3 Data analysis:

This research journal addresses the analysis based on the objectives. The analysis of effects requires testing for the relationships first between the variables under study. This is achieved by carrying different tests. To analyse the influence of agricultural components on price fluctuation, the researcher employs both statistical and econometrics approaches.

6 | DATA ANALYSIS AND DISCUSSION

Year	Coffee production (tone)	Coffee Demanded (tone)	Coffee supplied (tone)	Coffee exported	Coffee imported (tone)	Temperature (Max 0c)	Rainfall (mm)	Government subsidies (fertilizers)
2009	19372	15540	19319	15540	20	26	1210	1.3
2010	19319	18777	21820	18777	112	26	1000	0.1
2011	21820	15210	19995	15210	753	25	1000	0.1
2012	19995	18827	18346	18827	917	25	1150	5.1
2013	18346	18856	16379	18856	1084	25	1135	11.2
2014	16379	16262	21808	16262	893	25	900	12.6
2015	21808	17052	24120	17052	3108	25	950	19.7
2016	24120	17953	317185	17953	1452	26	860	10.9
2017	317185	15400	386430	15400	1382	26	1052	12
2018	386430	20780	20780	20780	2994	27	1212	12.6
2019	293660	20780	293660	20780	2994	27	1100	7.5

Data

The journal has the objective of analysing the influence of price fluctuation on coffee production in Rwanda, the contribution of weather condition, quantity demand and quantity supplied on coffee production in Rwanda

6.1 Data used:

Table 1: Data
Source: Rwanda Agricultural board (RAB)

4.2 Correlation analysis:

	PROD	EXP01	IMP	DEM	RAIN	SUBS	SUPP	TEMP
PROD	1	0.51607	0.4080	0.3327	0.1234	0.5406	0.622	0.9049
EXP01	0.516	1	0.3581	0.1749	0.2778	0.2657	0.6875	0.3990
IMP	0.4080	0.5038	1	0.2224	0.7742	0.4563	0.4836	0.258
DEM	0.3327	0.4	0.6018	1	0.2159	0.6186	0.2847	0.1479
RAIN	0.1234	0.3811	0.7552	0.0248	1	0.5247	0.7007	0.4331
SUBS	0.5406	0.5038	0.4013	0.1633	0.4836	1	0.1536	0.6315
SUPP	0.622	0.3327	0.0784	0.119	0.1234	0.5440	1	0.5471
TEMP	0.9049	0.8174	0.4473	0.1447	0.1193	0.2647	0.252	1

Table 2: Correlation analysis

The movement of Coffee Production, PROD, EXP, IMP, DEM, RAIN, SUBS, SUPP, and TEMP over the study period were examined in correlation analysis as shown in Table 2 Correlation analysis is usually conducted to determine the variables that are highly correlated and those that are less correlated. This means that in cases of highly correlated variables, one can linearly predict one variable from the other with a significant level ofaccuracy.

As indicated in Table 2, exports have had a strong positive correlation coffee production; IMP with a correlation with

Coffee production, Rain has had a weak correlation with coffee correlation, SUBS has had a moderate correlation with Coffee production, SUPP had a strong correlation with coffee production and TEMP has had a moderate correlation with coffee production. This implies that EXP has contributed to PROD 51.6%, IMP contributed to PROD to 40.8%, DEM contributed to PROD 33.27%, RAIN contributed to coffee production to 12.34, SUBS contributed to 54.06% to PROD .SUPP has contributed to 62.2% to coffee production and temperature contributed to coffee production 90.9%

Weather represented by temperature and rain. Therefore, temperature is strong correlated with coffee production, Rain is less correlated with coffee production, we can conclude that weather is correlated with coffee production. In other words, weather condition has influence on coffee production.

Supply is strong correlated with coffee production therefore supply has influence on coffee production

Demand is less correlated with coffee production; in otherwise demand has influence on coffee production.

Demand, Supply, Weather condition are the factor which cause price of agricultural product change or shift, all of this factor correlated with coffee production its means that all factors have had influence on coffee production

To test normality of the residuals, histogram-normality test is used, and the results are as shown in figure below. The Jarque-Bera statistics is greater than 5% level of significance and therefore accept the null hypothesis of normality of the residuals. The above test on coffee production indicates that all factors are significantly contribution to the price fluctuation in Rwanda from 2009 to 2019.

6.3 Regression analysis:

Test Equation:
Dependent Variable: Production
Method: Least Squares
Date: 04/19/21 Time: 16:10
Sample: 2009 2019
Included observations: 11

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.06	6.72	0.1577745	0.2127
EXP01	0.132	0.746	1.768981	0.0150
IMP	0.48	0.093	2.48277	0.0199
DEM	-0.40	0.062	-2.531311	0.0853
RAIN	0.48	1.29	3.729363	0.0336
SUBS	0.842	2.92	0.288366	0.7918
SUPP	0.972	0.104	9.34551	0.0411
TEMP	0.329	0.074	4.44594	0.03170

R-squared	0.883617	Mean dependent var	3.66
Adjusted R-squared	0.612057	S.D. dependent var	5.22
S.E. of regression	3.25	Sum squared resid	3.17
F-statistic	3.253852	Durbin-Watson stat	3.24
Prob(F-statistic)	0.180349		

(Source: Author's calculations)

Table 3

Econometrics equation

Prod=-1.06+0.132EXP+0.48IMP-0.40DEM+0.48RAIN+0.842SUB+0.972SUPP+0.329TEMP

This is the regression analysis; it is interpreted under the stated objectives.

Based on the coefficients:

Objective one: The coefficient of TEMP and RAIN are 0.329 and 0.48, it implies that 32.9% of TEMP has contributed positively to PROD and it increased by 32.9% by one percent of PROD and its probability of less than 5% thus, it is statistically significant and has contributed to PROD positively, thus positive relationship.

Objective two: The coefficients demand shift is -0.40 which implies that demand shift has decreased by 40% to one per cent of PROD and its probability of 0.085 this implies that demand shift decreased by 40% on one percent of PROD and statistically insignificant since the probability is greater than 5%

Objective three: Supply shift on coffee production contributed to 97.2% to coffee production and its probability is less than 5%, it implies that 97.2% of supply shift increased to one unit of coffee production.

Finally the intervening variables, one is the exports which has contributed positively to PROD since it has increased by 13.2% on one unit of PROD and also the probability is less than 5%, thus there is weak relationship between EXP and PROD ,IMP, its coefficient is 0.48 which implies that it has increased by 48% on one unit of PROD and its probability of less than 5%, there is a positive relationship despite its lower probability and government subsidies such as fertilizers used which is 0.842 which implies that there is no relationship between fertilizers used and coffee production, its probability was 0.79.Thus it implies the fertilizers have increased by 84.2% by one percent of PROD.

6.4 Stationarity test:

After getting the data, the researcher has had to test the stationarity in E-view program to see if the series which states that the value of the variable doesn't change with time.

Testing of Unity Root Test

H0: Variable has unity root

H1: Variable is stationary (has no unity root)

Testing by using Augmented Dickey Fuller test (ADF).

"If the ADF t calculated is greater than the critical value we accept the H0, otherwise we reject the H0.

Test of Temperature (TEMP) Unit Root test

Augmented Dickey- Full Test P = 0.0032 is less than 1%, 5% and 10% (0.01, 0.05 and 0.10) mean that we reject H0, it means that we accept H1: The variable is stationary has not unit root. Temperature is I (1)

Supply (SUP) of coffee unity root test

The Augmented dickey full test the P = 0.0001 values is less than the critical values (0.01, 0.05, 0.10) equivalent to 1%, 5% and 10% respectively. Means that I reject H0: and accept H1: the supply of coffee has not unity root test it means that is stationary Supply is I(1) without trend.

Demand (DEM) of coffee Unity root test

Augmented Dickey fuller Test the P value is less than the critical values 0.01, 0.05, 0.10 it means that we reject H0, and accept H1 : the variable has not a unity root means (it is stationary) demand is I (1) with trend and intercept.

Export (DEM) unity root test

Augmented dickey fuller test P= 0.0021 value is less than critical values of 0.01,0.05 and 0.10 it means that we reject H0,and accept the H1: which mean the variable has not a unity root , is stationary in other word the export is I (1) without trend and intercept

Import (Imp) unity root test

The Augmented Dickey fuller test P values =0.0010 is less than the critical values 0.01, 0.05, 0.10 it means that we reject H0 and accept the H1: means that the variables has not unity root it means that is stationary. Import is I(1) without trend and intercept.

Rain fall unity root test

The Augmented Dickey fuller test, P value = 0.0035 is less than the critical values that means H0 is rejected and accept H1: the variable has not unity root test (the variable is stationary) it means rain fall is I(1) without trend and intercept.

Fertiliser (FERT) Unity Root Test

Augmented Dickey fuller test of Fertilizer variable P value = 0.0070 is less than the critical values 0.01, 0.05, 0.10 we reject H0 and accept H1: the variable has not a unity root test means that is stationary is I(1) without trend and intercept.

Coffee production (Y) unity Root Test

The Augmented Dickey fuller test the P values = 0.0070 is less than the critical values of 0.01, 0.05, 0.10 means that we reject H0 and accept H1: mean that the variables has not a unity root it means that is stationary is I(2) without trend and intercept.

6.5 Interpretation and presentation of result:

Based on the calculation and the result shown in table 2, table 3 we find that weather condition has influence on coffee production, demand and supply have influence on coffee production.

The calculation are statistical significant that means;

H1: Weather condition has had a significant influence on coffee production

Objective 1 influence of weather condition on coffee production, ADF Test 0.0032 is less than 0.05, it implies that we reject H0, and we accept H1: The temperature is stationary and has not unit root.

ADF test of rain, P value = 0.0035 is less than the critical values that means H0 is rejected and accept H1: the rain has not unity root test implying that the rain is stationary.

H2: Demand shift has had influence on coffee production

Objective 2 supply shift have influence on coffee production, The Augmented dickey full test the P = 0.0001 values is less than the critical values 5%. This means that I reject H0: and accept H1: the supply of coffee has not unity root test means that is stationary Supply.

H3: Supply shift has had a significant influence on coffee production.

Augmented Dickey fuller Test the P value is less than the critical values 0.05 it means that we reject H0, and accept H1: the variable has not a unity root means that is stationary.

Therefore, weather condition; supply shift and demand shift have an influence on coffee production. This is evidenced by the values of probabilities which are less than the critical value or the t-statistics at 5% level

7 | SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 Summary of the findings:

The main objective of this research journal is to examine how price fluctuation affects the coffee production in Rwanda. The examination has been done by regressing coffee production on independent variables (TEMP, RAIN, DEM, SUPP, EXP, IMP, SUBS) using different tests. The researcher has employed both statistical and econometrics approaches under the stated objectives

i. First objective: H_1: The temperature (TEMP) and rain (RAIN) have had a significant influence on coffee production.

The coefficient of TEMP and RAIN are 0.329 0.48, it implies that 32.9% of TEMP has contributed positively to PROD and it has increased by 32.9% by one unit of PROD and its probability of less than 5% thus, it is statistically significant and contribute to PROD positively , thus positive relationship

ii. Second objective: H_2: The Demand shift has had a significant influence on coffee production.

The coefficients demand shift is -0.40 which implies that demand shift has decreased by 40% to one unit of PROD and its probability of 0.085 to 96.9% this implies that demand shift has decreased by 40% on one unit of PROD.

iii. Third objective: H_3, demand shift has had a significant influence on coffee production.

Supply shift on coffee production has contributed to 97.2% to coffee production and its probability less than5%, it implies that 97.2% of supply shift has increased to one percent of coffee production.

Finally the intervening variables, one is the exports which have contributed positively to PROD since it has increased by 13.2% on one percent of Production and also the probability is 17.5% less than 5%, thus there is weak relationship between EXP and PROD, IMP, its coefficient is 0.48 which implies that it has increased by 48% on one percent of production and its probability of 0.03, there is a positive relationship and government subsidies such as fertilizers used is 0.842 which implies that there is a strong relationship between fertilizers used and coffee production, its probability of less than 5%.Thus it implies the fertilizers have increased by 84.2% by one per cent of PROD.

7.2 Conclusions:

Based on the following analysis, there was influence of price fluctuation on coffee production, based on the objectives, the researcher uses statistical and econometrics approaches to explain the relationship, based on correlational analysis; all variables h

Objective one:

Rain has had a weak correlation with coffee production and temperature had a strong correlation with Coffee production, thus there is a higher correlation. Thus, the researcher concludes that temperature has a strong influence on coffee production while there is a weak influence of rain on coffee

production to represent weather that means it has had strong correlate with coffee production.

7.3Recommendation:

In the pursuit of this research journal, several research gaps emerge that need to be bridged in future studies. Since the journal employs a quantitative research design entailing time series data and future studies could use panel data and then compare the research findings. The government should concentrate on the macroeconomic framework that aims strengthen the agriculture sector through:

Increase of demand and supply of agriculture products to increase the internal market through exports.Strength the foreign cooperation to deal with climate change so that the rain and temperature can be the solution for Rwandan agriculture. Focus on the subsidy since the findings reveal that they influence the agriculture production

8 | REFERENCES

[1]. ***Adejuwon, S.A. (2004).*** *Impact of climate variability and climate change on crop yield in Nigeria. Contributed paper to Stakeholders workshop on Assessment of Impact & Adaptation to Climate Change (AIACC).*

[2]. ***Bapna(2012).*** *Aggregate Supply Response of Crops in a Developing Region. Sultan Chand and Sons, Delhi.*

[3]. ***Carter, C., G. C. Rausser, and A. Smith (2012).*** *'The Effect of the U.S. Ethanol Mandate on Corn Prices'. Unpublished manuscript.*

[4]. ***Cochrane, W. W. (1993****). Development of American Agriculture: A Historical Analysis, 2nd edn. Minneapolis: University of Minnesota Press.*

[5]. ***Cardno (2017)*** *Agricultural development as a key role in food security and economic development in most of the world's population in rural area. 2. Nwa*

[6]. ***Dorosh,P.A (2009).****Price stabilization, international trade andnationalcerealstocks: World price shocksand policy response in South. Asia Grain Secur. 2009,*

[7]. ***Engle, R.F. and Granger, C.W.J. (2004)*** *Co-integration and Error Correction: Representation, Estimation and Testing. Econometrics , 59, 1259-1294.*

[8]. ***Eskola, (2005).*** *Agricultural marketing price and supply chain management, the case Tanzania.*

[9]. ***Gardner, B. L. (1992).*** *'Changing Economic Perspectives on the Farm Problem'. Journal ofEconomic Literature, 30: 62–101.*

[10]. ***Guo, Y.J. (2012)*** *Study on the Dynamic Relationship between Agricultural Product Price and Inflation Rate. Price Monthly , 8, 76-79. [4] Lu, F. and Peng, K.X. (2002) The Relationship between Food Price and Inflation in China (1987 ~ 1999). Economics , 4, 41-45.*

[11]. ***Liu, X.M. (2008)*** *Study on the Relationship between Grain Price and Consumer Price in China. Journal of Economic Problems , 4, 56-60.*

[12]. ***Lyson, K. and Frrington, B. (2006).*** *Purchasing and Supply Chain Management, Pearson Education Limited, Harlow; England*

[13]. ***Mchopa. A. Kazungu I. and Ndiege B. (2012).*** *Pricing issues and Perspective, 1st edition, Internal Printers ltd Moshi*

[14]. ***Mendelsohn, R., Ariel, D., & Arne, D. (2000).*** *Climate Impact on African Agriculture. Climate change, (45), 583-600*

[15]. ***Miszler, J. (2003).*** *Inflation and relative price variability: evidence from a co integration analysis, GoetheuniversityFrankfurt .*

[16]. ***Mwiinga (2009).*** *An assessment of tomato price variability and its effects on smallholder farmers, the case Lusaka*

[17]. ***Parsley, D.C. (1996).*** *Inflation and relative price variability in the short and long run, new evidence from the United States, Journal of Money, Credit and Banking.*

[18]. ***Poudel S, Kotani K (2013).*** *Climatic impacts on crop yield and its variability in Nepal: Do they vary across seasons and altitudes. Climate. Change 116(2):327–355.*

[19]. ***Sckokm, P.; Moro, D.(2006)****, Modeling the reforms of the common agricultural policy for arable crops under uncertainty. Am. J. Agric. Econ. 2006,*

[20]. ***Silver, M. and C. Ioannidis (2001****). Inter country differences in the relationship between relative price variability and average prices, Journal of Political Economy*

[21]. ***Slayton, T. (2010).*** *'The "Diplomatic Crop", or How the US Provided Critical Leadership in Ending the Rice Crisis'. In D. Dawe (ed.), The Rice Crisis: Markets, Polices and Food Earthscan Publishing.*

[22]. ***Wang, Q.Y. (2010)*** *, The Rise of Agricultural Product Price Will Not Caused Inflation-Simulation Analysis Based on the Price Model of Input-output Method. EconomicForum , 7, 23-26.*

[23]. ***Waty, K. (2000).*** *International Purchasing Study Guide, 1st edition. London: Chartered England, Pearson Education Ltd*