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IMPACT OF THE FINANCIAL CRISIS ON THE ECONOMY OF NIGER: TRANSMISSION CHANNELS

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Abstract

This paper examined the transmission channels of financial crisis to the economy of Niger. The econometric methodology used was the Vector Error Correction Model (VECM) framework. The stationarity properties and the order of integration of the data were first examined using the Augmented Dickey-Fuller (ADF) test. All the variables tested were stationary at first difference. Next, the Johansen approach to co-integration was applied to test for the long-run relationship among the variables. The Johansen test indicated the existence of 3 co-integrating equations, suggesting the existence of a long relationship among the variables. Finally, the VECM framework was used to analyse both the long run and short run dynamic causal relationship among the variables. The VECM revealed a causal relationship running from remittance, official development assistance and trade to GDP on the long run, indicating that remittance, official development assistance and trade are effectively transmission channels of the financial crisis to the economy of Niger on the long run. On the short run however, the VEC Granger-causality test revealed that only remittance and official development assistance have a causal impact on the economy.

Keywords: Financial crisis, Transmission channels, Remittance, Official Development Assistance, Trade, Niger, VECM

INTRODUCTION

Macroeconomic and financial stability are critical concerns for governments and policy-makers across the world. The damages of the previous global financial crisis witnessed on advanced economies, emerging markets and developing nations are the key reasons of these concerns. Additionally, the number of financial crisis that occurred in the last decades is increasingly recognised as a serious, worldwide public issue.

A key feature of financial crises is their contagion effects both at the domestic and international levels. The 2007-2008 financial crisis that originated in the United States, leading to the collapse of several large financial institutions, spread across the US borders and had a direct impact on advanced economies and emerging market with well-developed financial system. In developing economies however, particularly in Sub-Sahara Africa (SSA), the initial perception was that SSA economies would be spared from the impact of the financial crisis due to its low integration to the global financial system (AfDB, 2009). However, studies indicated that the financial crisis did hit SSA economies, in both direct and indirect ways (IMF, 2009b). For net exporters and economies in situation of fragility in the SSA region, the effects through the indirect transmission channels such as trade, Foreign Direct Investment (FDI), tourism, workers' remittances and official development assistance mostly dominated. (Allen and Giovannetti, 2011).

Although the global financial crisis did hit SSA economies, the impact varied by country due to the fact they are at different level of economic development and they have different level of integration into the global financial system (Ho, 2016). The economic conditions of SSA economies are not uniform. The level of economic development of Niger contrasts sharply with that of SSA economies undergoing industrialization and financial deepening. Unlike the financially developed SSA economies, the financial system of Niger is underdeveloped. Niger has a bank based financial system in developing stage. Bank credit to private sector is low and there are limited financial investment opportunities in the regional financial market. FDI is very low due to insecurity caused by terrorist groups from neighbouring countries, which discourages potential investors from investing. The economy, however is rich on raw material. Niger is one the largest uranium producer in the world and an important producer of oil. The economy is principally based on export of raw materials, commodities and agriculture. Uranium accounts for about 70% of the country's export earnings. Despite the wealth of raw materials in the land of Niger, development aid has been a major source of support for Niger's economic development as about 45% of the government's 2002 budget, including 80% of its capital budget, derives from donor resources. As of 2017, USD 1 billion was allocated by the World Bank's International

Development Association to boost Niger's development and fight poverty. It is clear that Niger is a net exporter and belongs to economies in situation of fragility.

Investigating the impact and transmission channels of the financial crisis has been the subject of a rich literature. In spite of the large amount of studies available on the global financial crisis in SSA, no study examined Niger as a single case study using the VECM framework to the authors' knowledge. Most related studies in SSA focus on cross-country panel analysis. That is why Allen and Giovannetti (2011) emphasized and recommended in their research that future studies relating to the impact of financial crisis on SSA economies should focus on single country analysis. Furthermore, financial crisis, by their very nature, affect any country irrespective of their level of economic development, be it small or large countries, rich or poor (Claessens and Kose, 2013). These highlight the importance of investigating the transmission channels of the financial crisis to a developing economy in situation of fragility such as Niger. As such, this study fills the gap in the financial crisis literature by analysing the transmission channels of financial crisis on the economy of Niger as a single case study in SSA. The objective of this study is therefore to determine the transmission channels of the financial crisis to the economy of Niger. To this end, this study sets out to investigate if the transmission channels selected in the financial crisis literature have a causal impact on the economy of Niger or not. The contributions of this paper are threefold: first, it advances the existing literature by providing evidence of the transmission channels of the global financial crisis to a developing country in situation of fragility as a single case study. It will act as a basis upon which other studies will build on to further the understanding of the transmission channels of financial crisis to developing countries sharing similar experience and comparable level of economic development as Niger. Lastly, the study findings will be relevant to policy makers and regulators in developing appropriate policies in response to future crises in economies sharing the similar characteristics and level of development as Niger.

The paper is organised as follows: section 2 briefly reviews the relevant literature. Section 3 defines the data and variables, explains the model specification and estimation procedures. Section 4 discusses the results and finally section 5 gives the conclusion and recommendations.

LITERATURE REVIEW

The widespread contagion of the global financial crisis in the world economies and the damages it engendered worldwide highlight the importance of having a good understanding of the impact as well as the transmission channels of the financial crisis. The empirical literature on the transmission channels of the global financial crisis distinguishes two main transmission

channels: the direct channels and the indirect channels. In this section, we give a brief review of previous studies on both transmission channels.

Since the outbreak of the Global financial crisis in the United states, the crisis spread through advanced economies and emerging markets mainly through financial market linkages and bank interconnectedness. Balakrishnan et al. (2009) examined how financial stress was transmitted from advanced economies to emerging markets using a new financial stress index, the Emerging-Market Financial stress index (EM-FSI), which builds upon the financial stress index proposed by Cardarelli, Elekdag, and Lall (2009). The methodology used was a two stages econometric analysis and panel data analysis for 18 emerging economies. Overall, the study revealed that financial stress tended to spread rapidly to emerging economies and the essential conduit of transmission was financial links. The study further revealed that although individual countries in the panel study respond differently, 70 percent of stress in advanced economies was transmitted to emerging economies; European banks have been a major source of financial stress and bank lending ties was a key transmission channels of the financial crisis.

In another work, Dooley and Hutchison (2009) analysed the transmission of the U.S. Subprime Crisis to 14 Emerging Markets by investigating how financial markets in emerging markets responded to the U.S. financial and real news during a period of intense financial turmoil. The econometric methodology used in the study was the Ordinary Least Square (OLS) regression method, Vector Autoregressive (VAR) method and Granger Causality. Using Credit Default Swap (CDS) as dependent variable for a sample period spanning from January 1, 2007 to January 19, 2009, the OLS indicated that U.S. financial and real news have had large impacts on CDS spreads in emerging markets, indicating that the financial crisis was effectively transmitted from the U.S. to emerging markets abroad over the whole sample period. Using Granger causality test to investigate the linkage between the US equity market and Mexican Equity market, the analysis showed a strong linkage between the US equity market and Mexican Equity market.

Banerjee and Vashisht (2010) examined the impact of the financial crisis on four emerging economies such as Brazil, Russia, India and China (BRIC). The study outlined the banking sector, capital markets, short term credit, FDI and Trade as main transmission channels. According to the authors, Brazil and Russia were mostly exposed to the crisis through the bank sector while India and China were hardly affected. Through the capital market, there was a general drop in the stock market indices; for Brazil, Russia and India in particular, the impact of the crisis through the stock market was quite strong. The short term credit declined in each of the BRIC economies, with Russia the most affected followed by Brazil. Through the Trade channel, all BRIC experienced a trade collapse; Russia experienced the largest impact

through the trade channel. Overall, the study showed that all BRIC economies suffered from the crisis and the level of financial integration varied widely in the BRIC economies: Brazil and Russia was highly integrated in the global financial system while India and China was not, which explained why Brazil and Russia were the most affected through the financial crisis. More recently, Grima and Caruana (2017) studied the effect of the financial crisis on emerging markets stocks markets returns. The focus of the study was on the BRIC economies. The econometric methodology used was the OLS regression analysis. Using the BRIC's stock market returns as dependent variable, the results from OLS methods showed that the US S&P500 stock market index influenced the BRICs stock market returns, indicating that the US had a big impact on the stock returns on emerging economies.

In developing economies, particularly in Sub-Sahara Africa, evidence indicated that the financial crisis touched SSA economies through the direct and indirect channels (IMF, 2009b, AfDB, 2009; Ho, 2016). The impact of the financial crisis through the direct channel has been weaker in SSA compared to advanced economies owing to the fact that they have limited exposure to sub-prime mortgage loans and the associated derivatives that were the origin of the crisis, and they were not closely integrated into the world financial markets. (South Centre, 2010 report 28). SSA has not experienced systemic banking crisis unlike the developed economies due to limited cross-border banking system linkages and a minimal exposure to complex financial products (IMF, African Department 2009). Nonetheless, frontier and emerging markets with relatively developed financial market such as South Africa, Nigeria, Kenya and Ghana suffered from falling equity markets, capital flow reversals, and pressures on exchange rates. (IMF, African Department 2009). Additionally, the banks' credit to the private sector declined in most countries (Ackah et al., 2009).

Even so, the financial crisis touched SSA economies mostly through the indirect channel. Aryeetey and Ackah (2011) examined the general impact of the global financial crisis on the African economies. The study indicated that the impact of the financial crisis was quite significant; highlighting the indirect channels through the real sectors as the main transmission channel. For SSA net exporters with underdeveloped financial system, the indirect transmission channels such as Trade, foreign direct investment, Official development assistance and remittance inflows mostly dominated. For example, Bandara (2010) analysed the impact of the global financial crisis on African economies using a panel VAR framework. The results indicated that the financial crisis did have an impact on African economies, mainly through the Exports and FDI channels. Similarly, Allen and Giovannetti (2011) examined the effect of the financial crisis on Africa by investigating the transmission channels of the crisis. The study revealed trade as the main transmission channel, with worker's remittance as the second strongest channel. In

another study, Berman and Martin (2011) examined how past banking crisis affected African exporters through the trade channel. Using gravity equation model, the study used past banking crisis data to analyse how banking crisis affected bilateral trade and if African exporters responded differently to crises experienced by their partner countries. The analysis results indicated that African exports are more negatively affected by recessions experienced by trading partner countries (income effect). Another important finding of the study was that African exporters are found to be more vulnerable to the banking crisis because of the under-development of their financial systems and their dependence on trade credit. For single country studies in the developing region, we note that Kazi, M. (2014) investigated the transmission channels of the global financial crisis in Tanzania. The study revealed the financial crisis had a significant effect on the economic growth of Tanzania, the most important channels being Foreign Aid, followed by export earnings. Additionally, Osadume and Mbachu (2017) investigated the impact of the global financial crisis on the Nigerian Economy over a period covering between 2000 and 2015. Using Ordinary Least Squares and Vector Auto regression (VAR) as the method of analysis, the authors uncovered that the global financial crisis adversely affected in a significant way the Gross Domestic Product (GDP), the Foreign Direct Investment, Stock market capitalization and Export earnings from crude oil.

METHODOLOGY

Data and Variables

Following Allen and Giovannetti (2011)'s review of transmission channels of the financial crisis in SSA, we hold that as Niger is a net exporter and belongs to SSA economies in situation of fragility with an underdeveloped financial system and a dependence on aid, the indirect transmission channel of the financial crisis predominated. The financial crisis literature outlined trade, remittance, FDI, official development assistance (Foreign aid) and tourism as the indirect transmission channels of the financial crisis. As such, the variables used to examine the impact and transmission channels of the financial crisis to the economy of Niger are defined as follows: the dependent variable represents the Gross Domestic Product (GDP) and the independent variables include Remittance (REM), Net Official Development Assistance (ODA) and Trade proxied as exports.

FDI and Tourism are omitted in the analysis because they have historically been insignificant in Niger. As of 2007, FDI accounts for only 0.64% of GDP, compared to Trade which accounts for 19.90%, 12.74% for Net ODA and 1.56% for remittance. (Allen and Giovannetti, 2011). Despite efforts from government to attract foreign investors, including those from US, as of April 2017, there were no US firms running in Niger (cia.gov).

This study uses annual time series data over the period from 1975 to 2016, which includes 42 observations. The coverage period was selected so that it incorporates sufficiently long annual data as the econometric method used in our study is sensitive to small sample size and quarterly data were unavailable. Unlike the ARDL approach to co-integration that is suitable for small sample size, the co-integration technique used in this study requires enough long data sets. All data were collected from the World bank database indicators.

Model Specification

The functional relationship between the variables used to examine the impact and transmission channels of the financial crisis to the economy of Niger is first expressed through the following equation:

$$GDP = f(REM, ODA, TRADE) \quad (1)$$

We transform each variable into its natural logarithm and the equation (1) is represented in a log-linear model:

$$\ln(GDP_t) = \beta_0 + \beta_1 \ln(REM_t) + \beta_2 \ln(ODA_t) + \beta_3 \ln(TRADE_t) + \varepsilon_t \quad (2)$$

Where:

- $\beta 0$: The constant term.
- $\beta 1$: regression coefficient of the variable (REM)
- $\beta 2$: regression coefficient of the variable (ODA)
- $\beta 3$: regression coefficient of the variable (TRADE)
- t: The time trend.
- ε: The random error term assumed to be normally distributed.

Estimation procedure

The Vector Error Correction Model (VECM) is the estimation method used in this study. The VECM is a restricted Vector Autoregressive model (VAR) that determines both the long term and short term dynamic causal relationship among variables.

The VECM specification requires several conditions. The first condition requires all data to be stationary at first difference. Time series data tend to be non-stationary, thus they suffer from unit roots. Due to the non-stationarity property of time series data, regressions with time series data are very likely to result in spurious results. As such, the first step in the econometric analysis requires stationarity tests. In this study, we apply the Augmented Dickey-Fuller test to test for unit root. The second condition requires the variables to be co-integrated. According to Eagle and Granger, once the variables are co-integrated, the next step is to check for the error

correction model to examine the long run and short run dynamic of the model. Therefore, an important step in specifying the VECM is to test for co-integration in order to examine the long run equilibrium relationship among variables. In this study, we use the Johansen approach to co-integration. Implementing the Johansen test for co-integration requires including lags values or delays of the variables in the test. As such, we will specify the optimal number of lags prior to testing for co-integration.

Once all the variables are stationary at first difference and the Johansen co-integration test reveals the existence of a long run equilibrium relationship among variables, the Vector Error Correction Model can be specified.

The VECM to be estimated from this study is given by the following set of equations:

$$\Delta lnGDP_t = \alpha_1 + \sum_{i=1}^{k-1} \beta_i \, \Delta lnGDP_{t-i} + \sum_{n=1}^{k-1} \varphi_n \, \Delta lnREM_{t-n} + \sum_{m=1}^{k-1} \theta_m \, \Delta lnODA_{t-m} + \sum_{j=1}^{k-1} \gamma_j \, \Delta lnTRADE_{t-j} + \delta_1 ECT_{t-1} + \varepsilon_{1t} \quad (3)$$

$$\Delta lnREM_t = \alpha_2 + \sum_{i=1}^{k-1} \beta_i \, \Delta lnGDP_{t-i} + \sum_{n=1}^{k-1} \varphi_n \, \Delta lnREM_{t-n} + \sum_{m=1}^{k-1} \theta_m \, \Delta lnODA_{t-m} + \sum_{j=1}^{k-1} \gamma_j \, \Delta lnTRADE_{t-j} + \delta_4 ECT_{t-1} + \varepsilon_{2t} \quad (4)$$

$$\Delta lnODA_t = \alpha_3 + \sum_{i=1}^{k-1} \beta_i \, \Delta lnGDP_{t-i} + \sum_{n=1}^{k-1} \varphi_n \, \Delta lnREM_{t-n} + \sum_{m=1}^{k-1} \theta_m \, \Delta lnODA_{t-m} + \sum_{j=1}^{k-1} \gamma_j \, \Delta lnTRADE_{t-j} + \delta_3 ECT_{t-1} + \varepsilon_{3t} \quad (5)$$

$$\Delta lnTRADE_t = \alpha_4 + \sum_{i=1}^{k-1} \beta_i \, \Delta lnGDP_{t-i} + \sum_{n=1}^{k-1} \varphi_n \, \Delta lnREM_{t-n} + \sum_{m=1}^{k-1} \theta_m \, \Delta lnODA_{t-m} + \sum_{j=1}^{k-1} \gamma_j \, \Delta lnTRADE_{t-j} + \delta_2 ECT_{t-1} + \varepsilon_{4t} \quad (6)$$

Where, Δ is the difference operator for the logarithm values of the variables; k is the numbers of lags (k-1 is the lag length reduced by 1), $\beta, \gamma, \theta \; and \; \varphi$, are short run dynamic coefficients of the model, ECT_{t-1} represent the error correction term derived from the long-run co-integration relationship and ε_t are the residuals, or stochastic error terms in equation.

To determine the long term causality, the ECT has to be estimated from the VECM. A negative and statistical significant error correction term signify a long run causality. To estimate the short run causal effect among variables, we perform the Wald test, that is the Granger Causality test based on the Vector Error Correction model. Finally, we perform post-estimation diagnostic tests to ensure the reliability of our estimations and stability of the VECM.

In summary, the estimation procedure used in this study involves the following steps: first, unit root test; second, the optimal lag order selection; third, Johansen co-integration test; fourth, vector error correction model which comprises long run estimates and short run estimates (granger causality test) and finally post-estimation diagnostic tests.

RESULTS

Unit root tests

The results of the ADF tests are shown in the table 1 and table 2. The unit root test is carried out under the null hypothesis that the variable has a unit root against the alternative hypothesis that the variable doesn't have a unit root. Once the p-value of the test statistic is lower than the significance level (5%), we reject the null hypothesis of the existence of unit root. Otherwise, we fail to reject the null hypothesis, indicating that the variable has a unit root.

Table 1. ADF Unit root tests in levels

Variable	Intercept		Intercept & Trend		None	
	Test Statistic	Probability	Test Statistic	Probability	Test Statistic	Probability
LNGDP	-0.965378	0.7563	-2.014314	0.5760	1.488998	0.9640
LNREM	0.570734	0.9869	-2.122744	0.5182	2.092342	0.9899
LNODA	-1.147129	0.6878	-2.834031	0.1940	1.234195	0.9421
LNTRADE	-0.974199	0.7535	-1.403209	0.8452	1.510799	0.9656

Source: Authors' calculations using EViews 10.

Table 2. ADF Unit root tests in first difference

Variable	Intercept		Intercept & Trend		None	
	Test Statistic	Probability	Test Statistic	Probability	Test Statistic	Probability
D(LNGDP)	-4.476209***	0.0009	-6.391532***	0.0000	-6.538341***	0.0000
D(LNREM)	-7.170699***	0.0000	-7.075038***	0.0000	-7.294300***	0.0000
D(LNODA)	-7.003953***	0.0000	-6.888845***	0.0000	-7.106341***	0.0000
D(LNTRADE)	-6.826520***	0.0000	-6.826520***	0.0000	-6.870255***	0.0000

Note: ***, ** and * denotes rejection of the null hypothesis at 1%, 5% and 10% respectively.

Source: Authors' calculations using EViews 10.

The ADF tests in Table 1 and Table 2 indicate that all the variables are not stationary in their level form, but stationary at first differences, which shows that all variables are integrated of order one, I (1).

Optimal lag order selection

Given that all the variables are integrated in the same order and in their first difference I(1), the next step is to determine the optimal lag length necessary for the specification of the

Johansen co-integration test. In table 3, we obtain the lag length information criteria derived from the unrestricted Vector Auto Regression (VAR) estimate.

Table 3. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SBIC	HQ
0	-3034.642	NA	3.36e+64	159.9285	160.1009	159.9899
1	-2948.333	149.9056	8.35e+62	156.2281	157.0899*	156.5347
2	-2920.167	42.98954	4.54e+62	155.5878	157.1392	156.1397*
3	-2906.080	18.53600	5.43e+62	155.6884	157.9293	156.4857
4	-2881.543	27.12019*	4.05e+62*	155.2391*	158.1695	156.2817

Source: Authors' calculations using EViews 10.

As it can be seen from the table 3, most information criteria suggest 4 lags. Moreover, the information criteria with the lowest value also suggests 4 lags, therefore the optimal lag length for the specification of our econometric models is set to be 4 lags.

Johansen co-integration test

Having determined the order of integration of all variables I(1) and the optimal lag length criteria, we use the Johansen co-integration test to analyse the long-run equilibrium relationship among the four variables.

Table 4. Co-Integration Test Unrestricted Co-Integration Rank Test (Trace)

Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob**
None*	0.709748	92.76293	47.85613	0.0000
At most 1*	0.550696	46.99378	29.79707	0.0002
At most 2*	0.370417	17.39169	15.49471	0.0256
At most 3	0.007322	0.271898	3.841466	0.6021
Trace test indicates 3 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Authors' calculations using EViews 10.

Table 5. Co-Integration Test Unrestricted Co-Integration Rank Test (Maximum Eigenvalue)

Hypothesized No of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical value	Prob**
None*	0.709748	45.76915	27.58434	0.0001
At most 1*	0.550696	29.60209	21.13162	0.0025
At most 2*	0.370417	17.11979	14.26460	0.0172
At most 3	0.007322	0.271898	3.841466	0.6021
Max-eigenvalue test indicates 3 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values.				

Source: Authors' calculations using EViews 10.

For both co-integration rank tests (Trace and Max-eigenvalue) in Table 4 and Table 5, the null hypothesis that there exists at most 2 co-integration equations is rejected at 5% significance level, which indicates the existence of 3 co-integration equations. Both tests suggest the existence of a long run equilibrium relationship among the variables GDP, TRADE, ODA and REM.

VECM Estimates

We apply the VECM to examine the long run and short run dynamic causal relationship among the variables.

Long-run estimates

The VECM long-run estimation results is given in Table 6 in which the dependent variable is D(LNGDP). The figure of interest in the Vector Error Correction estimation results is the Error Correction Term (ECT), derived from the long run equation, which contains information of long run causality. We observe that the coefficient of the ECT in table 6 is negative which satisfy the first condition of long run causality. To establish long run causality, the error correction term also needs to be statistically significant. The null hypothesis states that there is no long run causality among the variables. The alternative hypothesis suggests the existence of long run causality. The null hypothesis is typically rejected at 5% significance level.

Table 6. Vector Error Correction Estimates

Dependent Variable: D(LNGDP)				
	Coefficient	Std. Error	t-Statistic	Prob.
ECT	-0.937567	0.318838	-2.940573	0.0041

Source: Authors' calculations using EViews 10.

As shown in table 6, the null hypothesis asserting no causal relationship in the long run between the independent variables REM, ODA, TRADE and the dependent variable GDP is rejected at less 1% significance level (0.0041). Coupled with the negative coefficient of the ECT (-0.937567), this indicates a causal relationship among GDP, REM, ODA and TRADE. Specifically, there is a long run causal relationship running from REM, ODA, TRADE to GDP. This shows that REM, ODA and Trade have a (negative) causal impact on GDP on the long run, thus revealing that REM, ODA, TRADE are effectively transmission channels of the financial crisis in the economy of Niger on the long run.

Short run estimates (VEC Granger Causality test)

Once the long run causality is determined, the short run causality needs to be examined. We apply the VEC Granger causality (Wald test) to analyse the short run causality among GDP, REM, ODA and TRADE. The null hypothesis states that there is no causal relationship among variables on the short run. The alternative hypothesis indicates the existence of a short run causal relationship among variables. The null hypothesis is rejected at 5% critical level.

Table 7. VEC Granger Causality/Wald test

Dependent variable: D(LNGDP)			
Excluded	Chi-sq	df	Prob.
D(LNTRADE)	2.635780	3	0.4513
D(LNODA)	12.37757	3	0.0062
D(LNREM)	9.842507	3	0.0200
All	31.25957	9	0.0003
Dependent variable: D(LNREM)			
Excluded	Chi-sq	df	Prob.
D(LNGDP)	1.549826	3	0.6708
D(LNTRADE)	2.700495	3	0.4401
D(LNODA)	7.215257	3	0.0653
All	11.84502	9	0.2222

Dependent variable: D(LNODA)			*Table 7…*
Excluded	Chi-sq	df	Prob.
D(LNGDP)	5.508087	3	0.1382
D(LNTRADE)	2.417438	3	0.4904
D(LNREM)	5.160883	3	0.1604
All	13.13930	9	0.1564
Dependent variable: D(LNTRADE)			
Excluded	Chi-sq	df	Prob.
D(LNGDP)	7.973305	3	0.0466
D(LNODA)	7.681584	3	0.0531
D(LNREM)	3.941344	3	0.2679
All	20.59520	9	0.0146

Source: Authors' calculations using EViews 10.

In table 7, we fail to reject the null hypothesis that TRADE does not Granger cause GDP. The p-value of the Wald F-statistic is very high. However, we reject the null hypothesis that GDP does not granger cause TRADE at 5% significance level. The null hypothesis stating that ODA does not Granger causes GDP is rejected at less that 1% significance level. Similarly, we reject the null hypothesis that REM does not Granger cause GDP at 2% significance level. In other words, ODA and REM Granger cause GDP. TRADE does not Granger cause GDP. Nonetheless, the null hypothesis that all the independent variables (TRADE, ODA and REM) do not Granger cause GDP is rejected at less than 1% significance level which is close to 0 (0.0003). Overall, the model shows there is a strong causal relationship between all the independent variables TRADE, ODA and REM and the dependent variable GDP on the short run.

The causal relationship between REM and GDP both on the long and short run, suggesting REM as a transmission channel of the financial crisis in the context of this study, is consistent with findings from previous studies in the SSA region (AfDB, 2009; Allen and Giovannetti, 2011; Essers, 2013; Ho, 2016;). Allen and Giovannetti (2011) even reported that the share of remittance is as high as 89% in Niger. In the case of ODA, this study also establishes strong causal relationship both on the short and long term, also indicating ODA as transmission channel of the financial crisis in Niger. This is not surprising because developing economies depending on ODA have been adversely affected by the financial crisis via a cut in foreign aid from developed economies experiencing economic downturn. The fact that donor resources significantly contribute to the budget and economic

development of Niger further reiterates the position of ODA as significant transmission channel of the financial crisis in Niger. On top of REM and ODA, the existence of long-run causal relationship between Trade and GDP in the context of this study reinforces the conclusive findings of several studies which indicated Trade as important transmission channel of the financial crisis in SSA economies (AfDB, 2009; Berman and Martin, 2009; Griffith-Jones and Ocampo, 2009; Essers, 2013; Allen and Giovannetti, 2011; Ho, 2016 etc.) as most SSA economies were negatively affected by the financial crisis through a decline in trade volumes and export earnings.

Post-estimation Diagnostic (Robustness) tests

To ensure the validity of our VECM estimations results, some diagnostics test need to be performed on the residuals of our model.

Serial correlation LM tests

In table 8 are displayed the VEC residuals serial correlation estimates. The null hypothesis states that there is no serial correlation at lag h. The probability value at each lag is higher than the 5% significance level indicating that there is no serial correlation in the model's residuals.

Table 8. VEC Residual Serial Correlation LM tests

Lag	F-statistic	Prob.
1	1.470279	0.1469
2	1.615533	0.0972
3	1.306505	0.2285
4	0.517242	0.9264

Source: Authors' calculations using EViews 10.

Heteroscedasticity Tests

To check for heteroscedasticity, we apply the VEC Residual Heteroscedasticity Tests. The null hypothesis of the Residual Heteroscedasticity Tests states that the residuals have homoscedasticity. The alternative hypothesis indicates that the residuals have heteroscedasticity. As it can be seen in table 9, the probability value of the Chi-square statistic is 0.2083, much higher than the 5% significance level, which shows that the residuals have homoscedasticity.

Table 9. VEC Residual Heteroscedasticity Tests

Joint test	Chi-sq	df	Prob.
	278.2722	260	0.2083

Source: Authors' calculations using EViews 10.

Normality test

At this step, we check for the normality of the residuals using the Jarque-Bera test. The null hypothesis states that the residuals have a normal distribution against the alternative hypothesis that they have a non-normal distribution. As it can be seen from table 10, the individual probability values as well as the joint probability value are much higher than the 5% significance level. This indicates that the residuals have a normal distribution.

Table 10. VEC Residuals normality test

Component	Jarque-Bera	df	Prob.
1	0.218809	2	0.8964
2	1.659171	2	0.4362
3	1.198464	2	0.5492
4	0.633106	2	0.7287
Joint	3.709549	8	0.8823

Source: Authors' calculations using EViews 10.

Model Stability test

To test the stability of our model, we apply the CUSUM plot test. Fig. 1 shows that the CUSUM plot does not exceed the critical bounds of the 5% level of significance, showing that the model is stable over time. All the diagnostics tests previously performed show that our model is robust, therefore inferences from estimation results provide valid research findings.

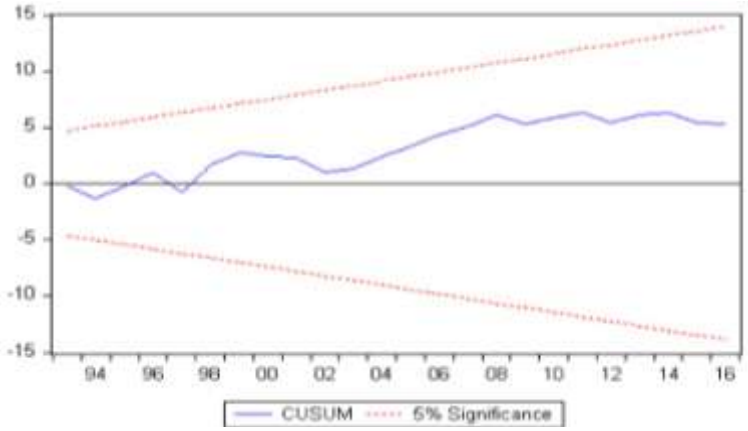

Figure 1. CUSUM plot

CONCLUSION AND RECOMMENDATIONS

This study set out to examine the transmission channels of financial crisis by analysing which channels had a causal impact on the economy of Niger. The economic condition and level of financial development of Niger determined the choice of transmission channels used for the study. Given that the financial system of Niger is underdeveloped and the economy is fragile, we used Remittance, ODA and Trade as the most appropriate channels of financial crisis to be tested in this study. The study therefore analysed the causal impact of Remittance, ODA and Trade on the GDP of Niger. All variables used for the study were first tested for stationarity using ADF unit root test. The ADF test indicated that all variables are not stationary in level form but stationary in their first difference. Given that all variables are integrated in the same order I(1), a co-integration test was performed to examine the long run relationship among the variables. Using the Johansen approach to co-integration, the test revealed the existence of a long equilibrium relationship among the variables. In the last step of the estimation procedure, the VECM was used to examine both the long run and short run dynamic causal relationship among variables. The VECM showed the existence of a long run causal relationship running from REM, ODA and Trade to GDP, in other words REM, ODA and Trade have a causal impact on GDP on the long run. On the short run, the VEC Granger causality test revealed that only ODA and REM Granger cause GDP; Trade does not granger cause GDP, but GDP Granger causes Trade. Various diagnostic tests such as serial correlation LM, heteroscedasticity and normality tests were performed to test for the accuracy and validity of the results. All post-estimation diagnostic tests indicated that the estimated results are robust and valid.

Overall, the research findings show that remittance, official development assistance and trade are effective transmission channels of the financial crisis to the economy of Niger. On the basis of these findings, a number of recommendation are outlined for policy-making:

(1) Government should aim at reducing its over-reliance on the export of few commodities and its focus on few markets. Uranium constitutes a substantial part of Niger's export. The decline in demand and price of Uranium have a significant repercussion on the economy of Niger, causing job cuts and lower revenues for the country. The government should actively engage in the development and multiplication of local manufacturing and food processing industries intended for both domestic consumption and exports. This, in one hand, will help the country cope with future crisis as Niger belongs to fragile economies who scored high in the vulnerability to food shocks resulting from the financial crisis. On the other hand, this will help the economy diversify its exports.

(2) The government should also aim at developing various strategies and measures aimed at generating funds domestically via diversified projects so as to reduce dependence on foreign

aid. Returns from those domestic projects could be ploughed back to the economy in order to promote development of various sectors. ODA has been instrumental in promoting economic development and fighting poverty in Niger. However, this put the economy in a vulnerable position as reduced aid flows put the country at risk of economic instability. While the government is encouraged to reduce dependence on aid, it should maximize the effective use of any aid it receives from donors by improving the institutions in charge and by targeting areas with the maximum impact on the economic development of the country.

(3) The government should mobilise resources to properly fight insecurity and eradicate radical groups and terrorist. This would help the country to attract foreign investors and boost the economy with significant inflows of investment and diversified projects as FDI is very low in the country.

(4) The government should engage in a comprehensive reform of the financial sector aimed at developing the banking system and increasing credit to private sector. Credit to private sector is significant at enhancing private investment and the economic development of a country. As more credit is supplied to the economy, both consumers and firms can borrow and invest more which in turn leads to job creation and a growth of income and profit.

This study determined the channels by which the financial crisis was transmitted in the economy of Niger but a limitation of this study transpired as it did not assess the sectorial impact of the financial crisis on the economy of Niger. So future studies could address this limitation by assessing the impact of the financial crisis on various sectors of the economy as well as the magnitude of such impacts.

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