Effect of abnormal credit expansion and contraction on GDP per capita in ECOWAS countries

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Abstract

We investigate the impact of abnormal credit expansion and contraction on the GDP per capita of ECOWAS countries. We analyse abnormal credit from two dimensions: first, the impact of abnormal credit contraction on GDP per capita, and second, the impact of abnormal credit expansion on GDP per capita. Using data for 10 ECOWAS countries from 1993 to 2021, we find evidence that abnormal credit contraction reduces the GDP per capita of ECOWAS countries. We also find some evidence that abnormal credit expansion reduces the GDP per capita of ECOWAS countries. More specifically, a unit increase in abnormal credit contraction decreases GDP per capita by 0.99 percent while a unit increase in abnormal credit expansion decreases GDP per capita by only 0.1 percent. The findings confirm that 'too little' or 'too much' credit does not improve economic output per person in immature financial systems. We also observe that banking sector solvency and a strong legal system have a positive effect on the GDP per capita of ECOWAS countries while banking sector efficiency has a negative effect on GDP per capita.

Keywords: finance, credit, economic growth, economic output, ECOWAS, GDP per capita, abnormal credit, domestic credit to private sector.

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1. Introduction

In this paper, we investigate the impact of abnormal credit expansion and contraction on GDP per capita in the Economic Community of West African States (ECOWAS) countries.

In the literature, credit expansion has been associated with higher economic growth and a high likelihood of financial crisis. This is because credit expansion – through increases in credit to the private sector – often leads to higher investment and output by firms and higher consumption by households which increases gross domestic product and leads to growth (e.g., King and Levine, 1993; Beck et al, 2000; Levine et al, 2000; Aghion et al, 2005; Ang, 2008). However, credit risk usually builds up during credit expansion and credit risk can materialize into losses that trigger a financial crisis (Kaminsky and Reinhart 1999; Schularick and Taylor, 2012). In contrast, credit contraction has been associated with low economic growth and even deeper recessions (Calvo and Coricelli, 1993; Bentolila et al, 2018). The above papers show that although credit expansion leads to faster economic growth, it is also a reliable predictor of financial crisis. While these contrasting effects abound in the finance-growth literature, there is overwhelming evidence that credit is good for the economy up to a threshold above which too much credit will harm growth especially in developed countries (Arcand et al, 2015; Cecchetti and Kharroubi, 2019). But what is true for developed economies may not be true in African countries due to the presence of inefficient financial intermediation and the underdeveloped financial system in African countries and in West African countries.

We revisit the finance-growth relationship, and investigate the effect of abnormal credit expansion and contraction on economic output per person (or economic development). We advance the literature by investigating the effect of abnormal credit expansion and contraction on economic output per person in the context of ECOWAS countries. In ECOWAS countries, lending institutions unexpectedly reduce or increase credit to the private sector in response to a change in incentives, a change in government policy or in response to general changes in the macro economy (Kusi et al, 2017). This practice gives rise to abnormal credit dynamics in ECOWAS countries. The ECOWAS countries also have a very low ratio of credit to the private sector to GDP which stands at 15 percent according to the World Bank. This percentage is far below the global

benchmark of 50 percent. Also, all ECOWAS countries rely on a bank-based financial system instead of a market-based financial system which is common in developed countries. The financial system of ECOWAS countries is dominated by banks and banks supply over 65% of the total credit in the credit market of ECOWAS countries. The implication is that banks in ECOWAS countries can unexpectedly decrease or increase credit to the private sector depending on bank-specific incentives, prevailing market conditions and changing macroeconomic conditions. Furthermore, recent developments in West African countries have shown that abnormal credit expansion or contraction might become a common occurrence in ECOWAS countries due to frequent externally-induced economic crises, high dependence on oil, high level of inflation, shallow credit markets and underdeveloped financial systems in ECOWAS countries (Oima and Ojwang, 2013; Afawubo, and Fromentin, 2013; Ozili et al, 2022). More importantly, the monetary authorities of ECOWAS countries are concerned that too much private credit can exacerbate inflationary pressures that could affect economic growth (Ozili et al, 2022), and that too little credit can also stifle growth by increasing the cost of credit which can lead to a fall in economic output and also affect GDP per capita (Olamide and Maredza, 2019). Given these concerns, we investigate whether abnormal credit expansion and contraction have a significant effect on GDP per capita in the region. Our study is the first study to examine the effect of abnormal credit expansion and contraction on economic output per person in African countries and in ECOWAS countries.

In this study, we use the high and low values of the credit to the private sector to GDP ratio as a measure of abnormal credit expansion and contraction. The credit to private sector to GDP ratio is a common indicator of financial depth. It measures the credit provided by the financial sector as a whole including banks, other financial institutions, and financial markets in a country compared to a measure of economic output mostly GDP. Existing studies have used the credit to the private sector ratio as a proxy for financial depth or financial development (King and Levine, 1993; Arcand et al, 2015; Angeles, 2015). Using data for ECOWAS countries from 1993 to 2021, we find evidence that abnormal changes in credit, especially abnormal credit contraction, negatively affects the GDP per capita of ECOWAS countries. More specifically, a unit increase in abnormal credit contraction decreases GDP per capita by 0.99 percent while a unit increase in

abnormal credit expansion decreases GDP per capita by only 0.1 percent. The findings offer insight into the consequences of abnormal changes in private credit on the GDP per capita. It shows that abnormal change in private credit has a more severe consequence on GDP per capita when there is abnormal credit contraction relative to abnormal credit expansion. The findings can help policy makers and academic economists in ECOWAS countries to understand how abnormal credit dynamics affect the GDP per capita of ECOWAS countries.

This study contributes to the existing literature in the following ways. First, the study contributes to the economic literature that assess the finance-growth relationship. Existing studies in this literature include: Bencivenga and Smith (1991), King and Levine (1993), Levine (2005), Rajan (2005), Beck et al. (2014) and Arcand et al (2015). The present study contributes to this literature by analyzing the potential effect of abnormal credit expansion and contraction on a specific measure of economic output per person with particular focus on ECOWAS countries.

The rest of the paper is structured as follows. Section 2 presents the literature review. Section 3 presents the methodology. Section 4 presents the empirical results. Section 5 presents the conclusion.

2. Literature review

The theoretical literature has shown that finance is intimately connected with growth. Schumpeter (1911) argued that a well-working financial system plays an essential role in promoting economic growth and development. Levine (2005) demonstrate how the services provided by the financial sector can contribute to economic growth. Levine (2005) showed that the financial sector can contribute to economic growth by (i) producing ex-ante information about investment opportunities; (ii) improving ex-post monitoring of investment and exerting corporate governance; (iii) facilitating risk management and diversification; (iv) mobilizing and pooling savings; and (v) easing the exchange of goods and services. Bencivenga and Smith (1991) argued that the size of the financial system contributes positively to economic growth through increased efficiency of financial intermediation in the financial sector.

Despite the positive prediction about the role of finance on growth, Rajan (2005) argued that large financial systems are more prone to volatility risk and financial speculation, and these fragilities could trigger a financial crisis. Beck et al. (2014) supports Rajan (2005)'s view. Beck et al. (2014) showed that intermediation activities in large financial sectors may have a positive effect on growth, but the expansion of the financial sector to other non-intermediation activities yield no benefit for long-run growth. In response to Rajan's view, Ranciére et al. (2008) and Arcand et al (2015) pointed out that even though a large financial sector may increase volatility risk, it does not necessarily mean that large financial systems are bad because countries that have large financial sectors will pay a price in terms of volatility but such countries will be rewarded in terms of higher growth.

Regarding how credit affects growth, Miller (1988) argued that financial intermediaries such as banks and other financial institutions do a better job in allocating credit towards productivity, investment and output growth. A well-established view about the link between credit and growth is the view that credit to the private sector leads to higher investment and output by firms and higher consumption by households which increases gross domestic product and leads to economic growth (as shown in King and Levine, 1993; Beck et al, 2000; Levine et al, 2000; Aghion et al, 2005; Ang, 2008). But household credit may raise debt levels without having much effect on growth (Angeles, 2015; Sassi and Gasmi, 2014). This has led to the argument that the way in which credit affects economic growth may also depend on whether lending is used to finance investment in productive assets or to feed speculative bubbles (Arcand et al, 2015). This again points to Rajan (2005)'s argument that credit expansion can feed speculative bubbles rather than increase growth. In fact, the 2008 financial crisis confirms Rajan (2005)'s view because excessive mortgage lending or "too much credit" prior to the crisis was used to speculate in derivative assets and securities which later led to the financial crisis in 2008 (Mian and Sufi, 2009; Coval et al, 2009).

Empirical studies show mixed evidence for the effect of private credit on growth. Samargandi and Kutan (2016) find evidence that credit to the private sector has a positive spillover effect on growth in some BRICS countries, specifically in China and India. Beck et al (2014) show that credit expansion has a positive significant effect on per capita output growth only up to a point above

which the effect is insignificant. This finding was corroborated by Arcand et al (2015) who show that there is a threshold above which credit to the private sector (or financial depth) no longer has a positive effect on economic growth. They show a "vanishing effect" when credit to the private sector reaches 100% of GDP, implying that the positive effect of private credit on GDP vanishes when credit to the private sector reaches 100% of GDP. In a related study, Sassi and Gasmi (2014) examine the effects of enterprise credit market and household credit market on economic growth. They find that enterprise credit market has a positive effect on growth while household credit market has a negative effect on growth.

De Gregorio and Guidotti (1995) examine the relationship between long-run growth and bank credit to the private sector. They find that bank credit to the private sector is positively correlated with growth but its impact changes across countries, and is negative for Latin American countries. However, they showed that the main channel of transmission from private credit to growth is the efficiency channel rather than the volume of investment channel. Ductor and Grechyna (2015) show that the effect of financial development on economic growth depends on the growth of private credit, and the effect of financial development on growth becomes negative when rapid growth in private credit is not accompanied by growth in real output. Polemis et al (2020) found a very weak relationship between domestic credit to private sector and economic growth. Pham and Nguyen (2020) examine the causality between domestic credit and gross domestic product in Vietnam from 2004 to 2017. They show that there is a two-way Granger causality relationship between credit and GDP. They also find that credit expansion has a negative impact on economic growth in Vietnam in the long run.

Few African studies, such as, Demetriades and James (2011) examine the relationship between finance and growth in sub-Saharan Africa. They find that bank credit does not exhibit a long-run relationship with real GDP per capita. Owusu (2012) examines the relationship between all aspects of financial liberalisation and economic growth in two ECOWAS countries. They find that stock market developments have a negative impact on economic growth in the two selected ECOWAS countries. Ozili et al (2022) focused on Nigeria and show that abnormal credit expansion increases GDP per capita when there are good institutions but decreases GDP per capita during a financial crisis. Although few African studies have examined the effect of finance on growth, no

studies have examined the effect of abnormal changes in private credit on GDP per capita in the African context. We fill the gap in the literature by narrowing our focus on the ECOWAS countries.

3. Methodology

3.1. Data

We collected country-level secondary data from the World Development Indicators (WDI) and the Global Financial Development indicators (GFDI) in the World Bank database. The population of the study is the 15 ECOWAS countries which includes: Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, the Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Of the 15 countries, only 10 ECOWAS countries have full reported data for the variables in the World Bank database, namely, Benin, Burkina Faso, Cote d'Ivoire, Ghana, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. The sample period is from 1993 to 2021 which is a 28-year period. The reason for choosing a long sample period is to ensure that the sample period is long enough to capture at least two full economic cycles where a full economic cycle is a 10-year interval. The reported data in the World Bank database ends at 2017 not 2021. The data for 2018, 2019, 2020 and 2021 was generated using a unique data forecasting approach that produces the forecast values by using a growth factor based on the GDP growth rate. This forecasting approach helps to avoid overstating the forecasted annual variables, and it ensures that the forecasted annual variables closely reflect the economic realities that occurred in the year. Eight variables were used in the empirical analysis. These eight variables have been used in previous studies such as Owusu (2012), Balke (2000), Gilchrist and Zakrajšek (2012), Arslan et al (2021), Popov and Rocholl (2018). The dependent variable is GDP per capita (CGDP). The three explanatory variables are domestic credit to private sector to GDP ratio (CS), a binary variable representing abnormal credit expansion shock (CSH), and a binary variable representing abnormal credit contraction shock (CSL). Four control variables were introduced in the model. They include central bank assets to GDP (CG), banking sector insolvency risk (ZSCORE), cost to income ratio of banks (CI) and the rule of law index (LAW).

Table 1. Variable description			
Variable	Description	Measurement	Data source
CGDP	GDP per capita	GDP per capita is gross domestic product divided by population.	World Development Indicators
CS	Domestic credit to private sector (% of GDP)	Domestic credit to private sector refers to financial resources provided to the private sector by other depository corporations (except central banks) as a proportion of GDP.	Global Financial Development indicators
CSH	Abnormal credit expansion shock variable	A binary variable that equals '1' if CS is above-the-mean, and zero otherwise. This identification follows the approach of Paravisini et al (2015)	Author's construct
CSL	Abnormal credit contraction shock variable	A binary variable that equals '1' when CS is less than 50% of the average of the CS distribution, and zero otherwise.	Author's construct
CG	Central bank assets to GDP (%)	Measures the ability of the Central Bank to intervene to resolve financial and credit crises using the assets in its balance sheet. The higher the ratio, the better.	Global Financial Development indicators
ZSCORE	Bank sector solvency	The ZSCORE measures the distance to default of the banking sector. The higher the ZSCORE, the better.	Global Financial Development indicators
CI	Banking efficiency	It measures the cost efficiency of the banking sector. It is measured as total income divided by total cost of the banking sector. The lower the CI variable, the better.	Global Financial Development indicators
LAW	Rule of Law index	Captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	World Governance Indicators

3.2 Model Specification

The dependent variable is the logarithm of GDP per capita. We estimate three models. The first model estimates both the effect of abnormal credit expansion and contraction on GDP per capita. The second model estimates the effect of abnormal credit expansion on GDP per capita. The third model estimates the effect of abnormal credit contraction on GDP per capita. The models are specified below.

$$LogCGDPi,t = \beta 0 + \beta 1CSi,t + \beta 2CSHi,t + \beta 3CSLi,t + \beta 4(CS * CSH)i,t + \beta 5(CS * CSL)i,t + \beta 6CGi,t + \beta 7ZSCOREi,t + \beta 8CIi,t + \beta 9LAWi,t + ei,t \ldots . eq1$$

$$LogCGDPi,t = \beta 0 + \beta 1CSi,t + \beta 2CSHi,t + \beta 3(CS * CSH)i,t + \beta 4CGi,t + \beta 5ZSCOREi,t + \beta 6CIi,t + \beta 7LAWi,t + ei,t \ldots . eq2$$

$$LogCGDPi,t = \beta 0 + \beta 1CSi,t + \beta 2CSLi,t + \beta 3(CS * CSL)i,t + \beta 4CGi,t + \beta 5ZSCOREi,t + \beta 6CIi,t + \beta 7LAWi,t + ei,t \ldots . eq3$$

Where, i = country; t = year. CGDP = GDP per capita (CGDP) which measures economic output per person. CS = domestic credit to private sector (% of GDP). CSH = a binary variable representing abnormal credit expansion shock. CSL = a binary variable representing abnormal credit contraction shock. CG = central bank assets to GDP (%). ZSCORE = banking sector solvency. CI = banking sector efficiency. LAW = rule of law variable. e = error term. The apriori expectation for all the variables is reported in table 2 below. The Hausman test shows that the fixed effect regression model is more appropriate. Therefore, the models are estimated using the panel fixed-effect regression method. This regression technique has been used in previous studies such as Hartarska et al (2015), Calderón and Liu (2003) and Nkurunziza (2010).

Table 2. Apriori expectations				
Variable	Short description	Apriori signs	Apriori prediction / expectation	Previous studies that support this prediction
CSH	Abnormal credit expansion shock variable	+/-	Can be positive or negative	Authors construct
CSL	Abnormal credit contract shock variable	+/-	Can be positive or negative	Authors construct
CS	Domestic credit to private sector (% of GDP)	+	Increase in credit to the private sector is expected to improve economic output or growth per person	Arcand et al (2015); Rousseau and Wachtel (2011)
CG	Central bank assets to GDP (%)	+	Increase in central bank assets is expected to improve economic output or growth per person	Beck et al (2000).
ZSCORE	Banking sector solvency	+	Increase in banking solvency is expected to improve economic output or growth per person	Lepetit and Strobel (2013), Soedarmono et al (2011)
CI	Cost-to-income ratio which measures banking sector efficiency	-	Increase in cost-income ratio should lower economic output or growth per person	Chortareas et al (2012).
LAW	Rule of Law index	+	Increase in legal system quality is expected to improve economic output or growth person	Haselmann and Wachtel (2010)

3.3. Descriptive statistics

Table 3 reports the average values for the data. For the individual countries, the credit to private sector (CS) variable is highest in Togo, followed by Senegal while the average CS variable is much lower in countries like Sierra Leone and Niger. The average CGDP is highest in Nigeria and much lower in Sierra Leone and Burkina Faso. Also, the average ZSCORE variable is highest in Cote d'Ivoire and is much lower in Togo. Meanwhile, the average CG is highest in Sierra Leone and is much lower in Benin and Burkina Faso. The average LAW variable is highest in Ghana and lowest in Nigeria. Finally, in the full sample descriptive statistics in table 3, some variables such as the CG, CS, ZSCORE, CI and LAW variables have a very low standard deviation which indicates that there is little variation between the observed values and the mean of the variables. Meanwhile, the CGDP variable has a high standard deviation which indicates that there is much variation between the observed values and the mean of the variables.

Table 3. Descriptive statistics (country-specific and full sample average values)

	ECOWAS / Variables	CGDP	CSL	CSH	CS	CG	ZSCORE	CI	LAW
	Countries	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
1	Benin	768	0.13	0.53	16.21	2.15	14.49	64.05	-0.50
2	Burkina Faso	552	0.10	0.63	18.62	3.11	8.28	59.96	-0.48
3	Cote D'Ivoire	1392	0	0.84	19.50	5.41	16.94	64.99	-1.03
4	Ghana	1289	0.13	0.34	12.71	13.32	7.71	51.01	0.02
5	Mali	657	0	0.69	17.93	2.76	9.68	65.45	-0.48
6	Niger	361	0.34	0.26	10.23	4.40	16.17	66.96	-0.63
7	Nigeria	1966	0.13	0.21	11.69	5.59	14.89	61.59	-1.11
8	Senegal	1270	0	0.81	20.17	3.98	14.44	62.61	-0.16
9	Sierra Leone	396	0.91	0	4.36	15.05	5.43	59.58	-0.97
10	Togo	568	0	0.87	25.78	4.75	4.42	66.19	-0.85
	Full sample:								
	Mean	922	0.17	0.52	15.72	6.05	11.25	62.24	-0.62
	Median	728	0.00	1.00	14.51	4.34	10.68	62.27	-0.65
	Maximum	2563	1.13	1.26	47.14	45.45	21.35	97.17	0.15
	Minimum	272	0.00	0.00	1.60	0.14	2.20	30.53	-1.47
	Standard Deviation	551	0.38	0.51	8.92	6.81	4.90	10.31	0.40
	No of observations	290	290	290	290	290	260	260	230

3.4. Pearson Correlation analysis

Table 4 presents the Pearson correlation analysis for the variables used in this study. Table 4 shows that the credit to private sector (CS) variable is significant and positively correlated with the GDP per capita variable. The economic significance of this result is that an increase in credit to the private sector is correlated with increase in economic output per person in ECOWAS countries. This means that the two variables move in tandem as improvement in one is correlated with improvement in the other. The two abnormal credit shock variables (CSH and CSL) are significantly correlated with the GDP per capita (CGDP) variable. Overall, the correlation of the variables is sufficiently low, therefore, multi-collinearity is not a problem in the analysis.

Table 4. Pearson correlation for all the variables

Variables	CGDP	CS	CSL	CSH	CG	CI	LAW	ZSCORE
CGDP	1.00							

CS	0.15**	1.00						
	(2.35)	-----						
	((0.01))	-----						
CSL	-0.36***	-0.55***	1.00					
	(-5.87)	(-10.02)	-----					
	((0.00))	((0.00))	-----					
CSH	0.07	0.72***	-0.49***	1.00				
	(1.11)	(15.76)	(-8.49)	-----				
	((0.26))	((0.00))	((0.00))	-----				
CG	-0.07	-0.37***	0.36***	-0.37***	1.00			
	(-1.07)	(-6.18)	(5.92)	(-6.04)	-----			
	((0.28))	((0.00))	((0.00))	((0.00))	-----			
CI	-0.04	0.11*	-0.01	0.15**	-0.43***	1.00		
	(-0.73)	(1.71)	(-0.16)	(2.39)	(-7.19)	-----		
	((0.46))	((0.08))	((0.86))	((0.01))	((0.00))	-----		
LAW	0.01	0.12*	-0.21***	0.15**	0.01	-0.20***	1.00	
	(0.01)	(1.90)	(-3.29)	(2.32)	(0.22)	(-3.18)	-----	
	((0.99))	((0.05))	((0.00))	((0.02))	((0.82))	((0.00))	-----	
ZSCORE	0.42***	-0.07	-0.18***	0.01	-0.25***	0.09	-0.11*	1.00
	(6.99)	(-1.11)	(-2.79)	(0.22)	(-4.05)	(1.39)	(-1.79)	-----
	((0.00))	((0.26))	((0.00))	((0.82))	((0.00))	((0.16))	((0.07))	-----

T-statistics are in single parenthesis. P-values are in double parenthesis. ***, **, * represent statistical significance at 1%, 5% and 10%. CGDP = GDP per capita. CSH = binary variable representing abnormal credit expansion shock. CSL = binary variable representing abnormal credit contraction shock. CS = domestic credit to private sector as a percentage of GDP. CG = central bank assets to GDP (%). ZSCORE = banking sector solvency. CI = banking efficiency. LAW = rule of law variable.

4. Empirical Results

We estimate the regression models after taking the logarithm of CGDP as the dependent variable. We first run the results jointly. Thereafter, we re-estimate the regression models separately to identify the separate effect of the positive and negative abnormal credit shocks.

4.1. Effect of abnormal change in credit to the private sector on GDP per capita

The main result is reported in column (i) of table 5 while the results for the separate effects of the positive and negative abnormal credit shocks are reported in columns (ii) and (iii) of table 5.

The CS coefficient is positive and significant in column (i). This result suggests that an increase in domestic credit to private sector variable (CS) leads to a significant increase in the GDP per capita of ECOWAS countries. The result supports the findings of Thierry, Jun, Eric, Yannick and Landry (2016) who find that credit to the private sector has a positive effect on the GDP per capita in Cameroun. The economic significance of the CS coefficient is that a unit increase in the level of credit to the private sector increases GDP per capita by 0.14 percent. The implication is that the monetary authorities in ECOWAS countries should encourage financial institutions to increase the level of credit to the private sector in order to improve economic output per person and this can translate to better standard of living for citizens in ECOWAS countries. However, this result does not mean that a persistent increase in credit to the private sector will always increase economic output per person at all times.

The CS*CSH coefficient is negative and significant in column (i). This indicates that an abnormal increase in domestic credit to the private sector (CS*CSH) significantly reduces GDP per capita in ECOWAS countries. This result supports the findings of Mian, Sufi and Verner (2017) who find that abnormal credit expansions lead to a significant decrease in GDP per capita in the United States. The economic significance of the CS*CSH coefficient is that a unit increase in abnormal credit expansion will decrease GDP per capita by 0.1 percent. This shows that abnormal credit expansions are not necessarily a good thing in ECOWAS countries because it decreases economic output per person in ECOWAS countries. Therefore, the monetary authorities in ECOWAS countries should be cautious in their monetary policy decisions. They should find the threshold

above which abnormal credit expansion harms economic output per person, and introduce policy measures to ensure that abnormal credit expansions do not reach or exceed the threshold.

The CS*CSL coefficient is negative and significant in columns (i) and (iii). This indicates that abnormal cuts in domestic credit to the private sector (CS*CSL) significantly reduces the GDP per capita of ECOWAS countries. The economic significance of the CS*CSL coefficient is that a unit increase in abnormal credit contraction will decrease GDP per capita by 0.99 percent. This shows that abnormal credit contraction will harm economic output per person in ECOWAS countries. Therefore, the monetary authorities in ECOWAS countries should use policy measures to discourage lenders from decreasing credit to abnormal levels both in good and bad times.

The ZSCORE coefficient is positive and significant at the 1% level in columns (i), (ii) and (iii). This indicates that greater banking sector solvency is associated with higher GDP per capita in ECOWAS countries. The economic significance of the ZSCORE coefficient is that a unit increase in banking sector solvency increases GDP per capita by at least 0.1 percent. This shows that increase in banking sector solvency helps to improve economic output per person in ECOWAS countries. Therefore, the monetary authorities in ECOWAS countries should ensure that the banking sector remains solvent so that the banking sector can contribute positively to GDP per capita.

The LAW coefficient is positive and significant at the 1% level in columns (i), (ii) and (iii). This indicates that the 'rule of law' variable is significant and positively related to GDP per capita. This implies that strong rule of law is significantly associated with better economic output per person in ECOWAS countries. The economic significance of the LAW coefficient is that a unit increase in the rule of law increases GDP per capita by at most 2.2 percent. This shows that increase in legal system quality helps to improve economic output per person in ECOWAS countries. Therefore, policymakers should introduce policies to strengthen the quality of the legal system, or the rule of law, as it can contribute positively to GDP per capita.

The CG coefficient is negative and significant in columns (i) and (iii) in table 5. This indicates that the size of central banks' balance sheet (CG) has a significant negative effect on GDP per capita. This implies that the larger the size of a central bank's balance sheet, the lower the GDP per capita in ECOWAS countries. The economic significance of the CG coefficient is that a unit

increase in the assets in central banks' balance sheet will decrease GDP per capita by at most 4 percent. This shows that increase in the assets in central banks' balance sheet does not improve economic output per person rather it decreases GDP per capita in ECOWAS countries. Therefore, central banks in ECOWAS countries should not be quick to increase their balance sheets since it does not contribute positively to GDP per capita.

The CI coefficient is positive and significant at the 1% level in columns (i), (ii) and (iii). This implies that an increase in the cost-to-income ratio of the banking sector leads to an increase in GDP per capita in ECOWAS countries. The economic significance of the CI coefficient is that a unit increase in the cost-to-income ratio will increase GDP per capita by at least 2.6 percent. This shows that increase in the cost-to-income ratio improves economic output per person in ECOWAS countries. Meanwhile, the two credit shock variables (i.e., CSH and CSL) have a significant positive effect on GDP per capita.

Table 5. Panel Fixed Effect Regression Estimations:
Effect of abnormal changes in private credit on GDP per capita

	(i)	(ii)	(iii)
Variable	Log(CGDP)	Log(CGDP)	Log(CGDP)
	Coefficient	Coefficient	Coefficient
	(t-statistic)	(t-statistic)	(t-statistic)
c	16.929***	17.415***	18.306***
	(20.34)	(21.20)	(30.21)
CS	0.095*	0.006	-0.022*
	(1.88)	(0.14)	(-1.65)
CSH	1.255**	0.278	
	(2.28)	(0.61)	
CS*CSH	**-0.1002****	-0.012	
	(-2.39)	(-0.37)	
CSL	6.144***		5.195***
	(7.08)		(6.71)
CS*CSL	**-0.994*****		**-0.921*****
	(-7.33)		**(-6.96)**
CG	-0.084***	-0.019	-0.076***
	(-4.83)	(-1.14)	(-4.39)
ZSCORE	0.104***	0.141***	0.119***
	(3.99)	(4.96)	(4.62)
CI	0.024***	0.019***	0.023***
	(3.77)	(2.67)	(3.58)
LAW	2.142***	1.855***	2.218***
	(8.17)	(6.39)	(8.44)
Country effect	Yes	Yes	Yes
Year effect	Yes	Yes	Yes
R^2	98.31	97.83	98.26
Adjusted R^2	97.95	97.39	97.92
F-statistic	275.40	226.52	284.23
P(F-statistic)	0.000	0.000	0.000

***, **, * represent statistical significance at 1%, 5% and 10% level, respectively. Log(CGDP) = logarithm of GDP per capita. CSL = binary variable representing abnormal credit contraction shock. CSH = binary variable representing abnormal credit expansion shock. CS = domestic credit to private sector as a percentage of GDP. CG = central bank assets to GDP (%). ZSCORE = banking sector solvency. CI = banking efficiency. LAW = rule of law variable.

4.2. Effect of the global financial crisis

We undertake additional analysis to determine the impact of abnormal credit to the private sector on GDP per capita during the 2007 to 2009 global financial crisis. Intuitively, we expect that the global financial crisis would introduce negative shock to the credit market in ECOWAS countries create incentives for credit providers to hoard credit and decrease credit to the private sector during the global financial crisis. However, this behavior is likely to be more pronounced in developed countries than in African countries. We test this hypothesis by introducing the 'DFC' binary variable which takes the value of 1 for the year 2007, 2008 and 2009 and zero otherwise. The DFC variable captures the global financial crisis period. We then interact the DFC variable with the CS*CSL variable to determine the impact of abnormal cuts in private credit on GDP per capita during the global financial crisis. We also interact the DFC variable with the CS*CSH variable to determine the impact of abnormal increase in private credit on GDP per capita during the global financial crisis. This indicates that the variables of interest are the DFC*CS*CSL variable and the DFC*CS*CSH variable. The results are reported in table 6. The DFC*CS*CSL and DFC*CS*CSH coefficients in table 6 are statistically insignificant. This indicates that the global financial crisis did not have a significant effect on the relationship between abnormal private credit and GDP per capita in ECOWAS countries. Despite the insignificance of the two results, the economic implication is that external financial crisis – that is, financial crisis that do not originate from Africa – does not affect the finance-growth relationship in ECOWAS countries.

Table 6. Panel Fixed Regression Estimations:
Effect of abnormal changes in private credit on GDP per capita during global financial crisis

	(i)	(ii)	(iii)
Variable	Log(CGDP)	Log(CGDP)	Log(CGDP)
	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
C	15.557*** (19.41)	15.659*** (19.67)	15.597*** (19.64)
CS	0.142*** (10.60)	0.141*** (10.74)	0.145*** (13.03)
CSL	0.133 (0.41)		0.088 (0.28)
CSH	0.105 (0.46)	0.078 (0.34)	
DFC	-0.475 (-0.93)	-0.806* (-1.88)	-0.682*** (-3.14)
DFC*CS*CSL	-0.222 (-1.22)		-0.185 (-1.15)
DFC*CS*CSH	-0.016 (-0.49)	0.003 (0.12)	
CG	-0.083*** (-4.52)	-0.081*** (-4.47)	-0.083*** (-4.56)
ZSCORE	0.154*** (4.34)	0.151*** (4.26)	0.150*** (4.34)
CI	0.019** (2.11)	0.018** (2.11)	0.019*** (2.17)
LAW	2.286*** (6.14)	2.296*** (6.18)	2.291*** (6.20)
Country effect	Yes	Yes	Yes
Year effect	No	No	No
R^2	95.83	95.81	95.83
Adjusted R^2	95.46	95.47	95.49
F-statistic	254.46	284.96	286.61
P(F-statistic)	0.000	0.000	0.000

***, ** represent statistical significance at 1% and 5% level, respectively. Log(CGDP) = logarithm of GDP per capita. CSL = binary variable representing arising from abnormal credit contraction shock. CSH = binary variable representing abnormal credit expansion shock. CS = domestic credit to private sector as a percentage of GDP. DFC = binary variable representing

the global financial crisis period between 2007 to 2009. CG = central bank assets to GDP (%). ZSCORE = banking sector solvency. CI = banking efficiency. LAW = rule of law variable.

4.3. Further analysis

We re-estimate the regression models in table 5 using alternative measures of abnormal credit shock. The purpose of the analysis is to verify whether the results confirm the earlier results obtained in table 5. The first alternative measure of abnormal credit shock is the one standard deviation above the mean (represented by CSH1 which measures abnormal credit expansion) and the one standard deviation below the mean (represented by CSL1 which measures abnormal credit contraction). We also use an extreme measure of abnormal credit shock which is the two standard deviations above the mean (represented by CSH2 which measures abnormal credit expansion) and the two standard deviations below the mean (represented by CSL2 which measures abnormal credit contraction). The results are reported in table 7. It can be seen that the CS*CSL1 coefficient is significant and negatively related to GDP per capita when we use one standard deviation below the mean to measure abnormal credit contraction. This result confirms our earlier result in table 5 and indicates that abnormal credit contraction has a significant negative impact on GDP per capita. Meanwhile, the CS*CSH1 coefficient is not significant when we use one standard deviation above the mean to measure abnormal credit expansion. Also, it can be seen that the CS*CSL2 coefficient is not significant when we use two standard deviations below the mean to measure abnormal credit contraction. Similarly, the CS*CSH1 coefficient is not significant when we use two standard deviations above the mean to measure abnormal credit expansion. Overall, the results show that our earlier findings that abnormal credit contraction harms economic output is robust to alternative measures of abnormal credit shock.

Table 7. Additional Panel Fixed Effect Regression Estimations using ± 1 and ± 2 standard deviation from the mean of CS variable

	Using +/- 1 standard deviation from the mean of CS variable			Using +/- 2 standard deviation from the mean of CS variable		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Variable	Log(CGDP)	Log(CGDP)	Log(CGDP)	Log(CGDP)	Log(CGDP)	Log(CGDP)
	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
c	18.318*** (27.45)	17.661*** (24.48)	18.379*** (30.03)	17.928*** (26.98)	17.560 (26.23)	17.956 (27.19)
CS	-0.013 (-0.53)	-0.009 (-0.37)	-0.019 (-1.46)	-0.002 (-0.09)	-0.0001 (-0.004)	-0.006 (-0.46)
CSH1	0.074 (0.09)	0.196 (0.21)				
CS*CSH1	-0.005 (-0.15)	-0.002 (-0.05)				
CSL1	5.419*** (6.61)		5.386*** (6.69)			
CS*CSL1	-0.956*** (-6.59)		-0.954*** (-6.64)			
CSH2				-4.225 (-0.79)	-4.262 (-0.78)	
CS*CSH2				0.092 (0.74)	0.094 (0.74)	
CSL2				-2.037 (-0.43)		-1.989 (-0.41)
CS*CSL2				1.810 (0.83)		1.784 (0.82)
CG	-0.076*** (-4.25)	-0.018 (-1.03)	-0.076*** (-4.34)	-0.464** (-2.47)	-0.019 (-1.11)	-0.045** (-2.45)
ZSCORE	0.106*** (3.98)	0.144*** (4.99)	0.107*** (4.09)	0.125*** (4.45)	0.142*** (4.97)	0.126*** (4.48)
CI	0.023*** (3.49)	0.019*** (2.61)	0.023*** (3.55)	0.019*** (2.73)	0.018** (2.55)	0.019*** (2.89)
LAW	2.227*** (8.23)	1.876*** (6.39)	2.225*** (8.40)	2.063*** (7.17)	1.878*** (6.50)	2.041*** (7.14)
Country effect	Yes	Yes	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
R^2	98.24	97.83	98.24	97.95	97.83	97.94
Adjusted R^2	97.87	97.39	97.89	97.52	97.40	97.53

F-statistic	263.97	226.09	280.71	225.93	226.79	239.01
P(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000

***, ** represent statistical significance at 1% and 5% level, respectively. Log(CGDP) = logarithm of GDP per capita. CS = domestic credit to private sector as a percentage of GDP. CSL1 = binary variable representing an alternative measurement of abnormal credit contraction shock. It is measured as one standard deviation below the mean of the CS variable which is equivalent to the 16th percentile. All CS values that are equal or less than the 16th percentile capture abnormal credit contraction. CSL2 = binary variable representing an alternative measurement of abnormal credit contraction shock. It is measured as two standard deviations below the mean of the CS variable which is equivalent to the 2nd percentile. All CS values that are equal or less than the 2nd percentile capture abnormal credit contraction. CSH1 = binary variable representing an alternative measurement of abnormal credit expansion shock. It is measured as one standard deviation above the mean of the CS variable which is equivalent to the 84th percentile. All CS values that are equal or above the 84th percentile capture abnormal credit expansion. CSH2 = binary variable representing an alternative measurement of abnormal credit expansion shock. It is measured as two standard deviations above the mean of the CS variable which is equivalent to the 98th percentile. All CS values that are equal or above the 98th percentile capture abnormal credit expansion. CG = central bank assets to GDP (%). ZSCORE = banking sector solvency. CI = banking efficiency. LAW = rule of law variable.

5. Conclusion

In the paper, we investigated the impact of abnormal credit expansion and contraction on GDP per capita in ECOWAS countries. We analysed abnormal changes in credit from two dimensions. The first dimension is abnormal credit expansion which is measured as abnormal increase in credit to the private sector while the second dimension is abnormal credit contraction which is measured as abnormal cuts in credit to the private sector.

We find strong evidence that abnormal credit contraction reduces the GDP per capita of ECOWAS countries. This indicates that abnormal cuts in credit to the private sector lowers economic output per person in ECOWAS countries. We also find some evidence that abnormal credit expansion reduces the GDP per capita of ECOWAS countries. This indicates that abnormal increases in credit to the private sector lowers economic output per person in ECOWAS countries.

The implication of the finding is that policy makers in ECOWAS countries need to pay attention to the consequence of abnormal changes in credit to the private sector in their countries. This is important because formal lenders in ECOWAS countries can unexpectedly increase or decrease the quantity of credit for reasons unrelated to borrowers' income. Such unexpected or abnormal increase or decrease the quantity of credit can significantly affect macroeconomic outcomes. Therefore, policymakers should introduce policies and measures that prevent financial institutions from making abnormal changes in private credit especially abnormal credit contraction due to its negative impact on economic output per person in ECOWAS countries. Also, the implication of the observed negative effect of abnormal credit expansion on economic output per person is that sudden increases in credit to the private sector harms economic output per person. Therefore, the monetary authorities in ECOWAS countries should find the "threshold" above which abnormal credit expansion harms economic output per person, and introduce policy measures to ensure that abnormal credit expansions do not reach or exceed the threshold. The study has some limitations. First, the study focused on abnormal credit to the private sector in aggregate terms. It did not investigate abnormal changes in private credit at the individual bank level, and it does not take into account any other changes occurring in the loan portfolio of individual financial institutions in ECOWAS countries. The second limitation is that the study focused only on ECOWAS countries. This means that the findings of the study cannot be generalized to sub-Saharan African countries. Future studies can extend the research in this paper by investigating abnormal credit expansion and contraction at the micro-level with a focus on individual financial institutions or banks. Future studies can also extend the analysis to sub-Saharan African countries.

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