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THE RELATIONSHIP BETWEEN CHANGES IN INFLATION AND FINANCIAL DEVELOPMENT

Sanusi K.A., Meyer D., Ślusarczyk B.*

Abstract: The relationship between inflation and financial development remains an important issue in the empirical and theoretical literature, but has yet to receive significant research attention. This paper examines this issue for South Africa by applying the bounds testing (ARDL) approach to cointegration using a monthly series for the period from 2007 to 2016. The bounds tests suggest that the variables are bound together in the long run when credit allocated to the private sector is the dependent variable. The associated equilibrium correction is also significant, confirming the existence of a long-run relationship. The results indicate significant Granger and ARDL causality from inflation to the credit allocated to private sector as a measure of financial development. The empirical finding implies moderate rise in price level would motivate financial development in South Africa. Hence, the study concludes that management of financial system must be conducted in a manner that would motivate a moderate increase in price levels.

Key words: Credit allocation, Financial development, Inflation, Management, ARDL, South Africa.

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Introduction

Inflation limits the role of money as a unit of account and as a monetary standard (Konieczny, 1994). Inflation affects money to efficiently and effectively perform its functions both as a means of exchange and as measurement of value (Stiglitz, 2005). Inflation is seen as one of the twin evils of macroeconomics with unemployment being the other one (Balamurali and Sivarajasingham, 2013). Volatile inflation is commonly regarded by monetary and fiscal authorities as undesirable and has a negative impact on any national economy (SARB, 1998).
Neoclassical theories have recognized asymmetric information as one of the important mechanisms through which inflation interferes with the effectiveness and efficiency of the financial sector to distribute resources (McKinnon, 1973; Boyd et al., 2001). Financial development involves the establishment and expansion of institutions, instruments and markets that support this investment and growth

* **Kazeem Abimbola Sanusi**, North-West University Vaal Triangle Campus, South Africa & Obafemi Awolowo University, Nigeria, **Daniel Meyer**, **Prof. Ph.D.** North-West University Vaal Triangle Campus, South Africa, **Beata Ślusarczyk, Prof. Ph.D.,** North-West University Vaal Triangle Campus, South Africa; Faculty of Management, Czestochowa University of Technology, Poland
✉ Corresponding author: daniel.meyer@nwu.ac.za
✉ sanusikazeemabimbola@yahoo.com; beata.slusarczyk@wz.pcz.pl

process (Eryigit and Eryigit, 2015). It can also be seen as improvements in the size, efficiency and stability of and access to the financial markets (Eryilmaz et al., 2014).

Moreover, recent economic theories have underscored the significance of informational asymmetries in financial markets (Konieczny, 1994). How an increase in the rate of inflation affects credit market frictions with resulting negative repercussions for the financial sector performance, has been explained in the recent economic theories (Huybens and Smith, 1999; Pochenchuk, 2014). An increase in the rate of inflation leads to a downward trend on the real rate of return of all classes of financial assets and the consequence of this is increased credit market frictions (Akinkoye et al., 2015). This undermines the ability of the financial sector to effectively allocate credit, and as a result becomes less efficient in resource allocation (Chuah and Thai, 2004). This in turn has an unfavourable effect on capital investment and consequently on the long-run, economic growth (Hassan and Bashir, 2003). The effects and impact of a well developed financial sector on economic growth has received a great deal of empirical attention in economic literature (Goldsmith, 1969; King and Levine, 1993a; King and Levine, 1993b; Levine and Zervos, 1998; Chuah and Thai, 2004; Hassan and Bashir, 2003; Khan and Senhadji, 2001; Hassan et al., 2011), while the effects of inflation on economic growth has received adequate empirical efforts in economic literature (De Gregorio, 1993; Fischer, 1993; Barro, 1995, 1998; Bullard and Keating, 1995; Sarel, 1996; Ghosh and Phillips,1998; Khan and Senhadji, 2001; Sirimaneetham and Temple, 2009; Bittencourt, 2012; Bittencourt et al., 2013). However, the relationship between inflation and financial sector development as one of the mechanisms through which both variables affects long run economic activities, has yet to receive the sufficient empirical research in the literature. Meanwhile, few existing studies have identified a significant relationship between inflation and financial sector development (Boyd et al., 2000; Yigit, 2002; Lee and Wong, 2005; Wahid et al., 2011; Akinkoye et al., 2015). More specifically, empirical studies on the relationship between inflation and financial sector development could not be found in South Africa. The closest empirical effort on this subject matter is Gondo (2009) which examined finance and growth nexus. This study therefore aims at contributing to the nexus between inflation and financial development in South Africa.

Empirical Review

Empirical studies on the interaction between inflation and financial development is limited as most of the studies in the literature have largely examined the relationship between financial development and economic growth. One of the ways identified theoretically and empirically in the literature via which inflation affects financial development, is through credit rationing (Driscoll, 1991; Gao et al., 2012). Credit rationing can be defined as a condition where borrowers' demand is not met or the non-price restrictions of loans (Driscoll, 1991; Cavalluzzo and

Cavalluzzo, 1998). Credit rationing is one of the major channels through which excessively high inflation mostly undermine financial growth. This is because financial institutions tend to exercise caution in their lending behaviour and are risk averse in an environment of price uncertainty (Craigwell and Kaidou-Jefferey, 2010; Miečinskienė and Lapinskaitė, 2014). Uncertainty in forecasting prices is an important issue, especially in making long-term decisions, such as investment (Hallegalle, 2009). This represents a major challenge for companies that are forced to revise development plans depending on inflation fluctuations (Leigh and Blakely, 2016). In this situation, the uncertainty "will reduce expectations about future profits and thus will reduce investments" (Baranowski, 2008; Nunese et al., 2017). The negative impact of inflation initiated by the uncertainty on investment has been found both in developing and developed countries, or, in other words, in countries of both high and low, or at most moderate inflation. This situation was confirmed by Ciżkowicz and Rzońca (2009) who implemented a series of studies in this area. Generally, companies operating in high inflation are exposed to its negative effects. The faster the price growth is, the greater the uncertainty of the business and the additional costs of the business remain (Martinuzzi, 2004). Therefore, managers must take account of this negative factor emerging from the business environment when making decisions regarding their functioning in the marketplace.

Using a regression analysis, Druck and Garibaldi (2000) show that inflation affects bank's portfolio decision; such that an increase in inflation will create an incentive for a bank's portfolio reallocation towards free risk assets. Their study is premised on the assumption that inflation has no effects on the expected return on both risk and risk free assets. They argued that limited liability on the part of borrowers, together with asymmetric information and costly monitoring in the borrower-lender contracts, induces a clear relation between inflation risk and bank's portfolio allocation. Druck and Garibaldi (2000) conclude that an increase in inflation risk creates the incentive to banks to invest in risk free assets, and consequently, banks reduce the credit lines to firms. In conditions of uncertainty, lenders are reluctant to invest funds for a long period of time. In return for long-term funding, they demand additional wages, which results in higher real interest rates and limited access to corporate loans for the companies. This evokes the necessity of verifying the external financing of entities' functioning and, in many cases, the abandonment of development activities. Boyd et al., (2001) investigate the effects of the rate of inflation on the ability of the financial sector to allocate resources effectively. Evidence from the study reveals that there is a significant and economically important, nonlinear negative relationship between inflation and both banking sector development and equity market activity. The study shows further that as inflation rises, the marginal impact of inflation on banking lending activity and stock market development diminishes rapidly. By means of a Tobit analysis of eight countries, Yigit (2002) investigates how inflation uncertainty adversely affects output by examining the impact of unpredictable inflation on credit markets.

Yigit (2002) concludes that non-diversifiable risks such as inflation uncertainty will cause financial agents to act in a risk-averse manner leading to disequilibrium in financial markets and will negatively affect total credit.
Lee and Wong (2005) examine the possible inflationary threshold effects in the relationship between financial development and economic growth using threshold autoregressive approach (TAR) in Taiwan and Japan. Their findings suggest that when the threshold level of inflation is below 7.25%, financial development may promote economic growth for Taiwan. However, when inflation is above 7.25%, financial development will not generate any significant impact on economic growth. On the other hand, empirical results suggest that when the threshold level of inflation is below 9.66% in Japan, financial development has a significantly profound impact on economic growth. However, financial development is detrimental to economic growth when inflation is above the threshold level. They conclude that the positive impact of financial development is dependent upon the threshold level of inflation. This argument is consistent with the findings of Huybens and Smith (1999), Bose (2002), and Rousseau and Wachtel (2002). Keho (2009) further examined these empirical positions using the bound testing cointegration. He concludes that no evidence of long-run relationship exists between inflation and financial development for six countries of West African Economic and Monetary Union (UEMOA) and no causality for two of the UEMOA countries. He argues that financial development causes inflation in four UEMOA countries, with evidence of reverse causation detected for only two countries. The study reveals further that causality patterns vary across countries and, therefore, indicate that it would be unwise to rely on inference based on cross-section countries studies which implicitly impose cross-sectional homogeneity on coefficients. Employing the ARDL bounds testing approach and Error Correction Method (ECM); Wahid et al. (2011) further examine the impact of inflation on financial development in case of Bangladesh for the period of 1985-2005. They show that high trends of inflation impede the performance of financial markets in the long-and-short runs, confirming an inverse correlation between inflation and financial development in the case of Bangladesh. In related studies, Daferighe and Charlie (2012) investigate the impact of inflation on stock market performance in Nigeria using time series data for twenty years from 1991-2010. They find evidence in favour of negative relationship between inflation and stock market indicators. This claim could not be confirmed by Akinkoye et al., (2015) as they could not establish significant causality between inflation and willingness to allocate credit in financial markets in Nigeria.

Econometric Methodology, Data & Variable Information

Test of Unit Root

Attempts to investigate if the levels or difference of a series is stationary leads to divergent conclusions, and hence motivated the need to test for non-stationarity, that is unit roots. Engle and Granger (1987), define a non-stationary time series to

be integrated after being differenced. This notion is usually denoted by $X_t \sim I(\mathrm{d})$. Hence all the series are tested for the probable order of difference stationarity by using the augmented Dickey-Fuller (ADF) and Phillips-Perron tests.

ARDL Modeling Specification

In order to examine the relationship between inflation and financial development, the autoregressive distributed lag (ARDL) bounds testing procedure suggested by Pesaran et al., (2001) is used. Essentially, the superiority of the ARDL is that the model takes sufficient numbers of lags to capture the data generating process in a general-to-specific modeling framework (Laurenceson and Chai, 2003). Moreover, a dynamic error correction model (ECM) can be derived from the ARDL model through a simple linear transformation (Banerjee et al., 1993). The ECM integrates the short-run dynamics with the long-run equilibrium without losing long-run information. It is also argued that using the ARDL approach avoids problems resulting from non-stationary time series data (Laurenceson and Chai, 2003). The test involves estimating by ordinary least square the following unrestricted error correction model (UECM) considering each variable in turn as a dependent variable. The estimated model for the study is given as follows:

$$\Delta FDV_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta FDV_{t-i} + \sum_{i=0}^{q} \gamma_{1i} \Delta INF_{t-i} + \emptyset_1 FDV_{t-1} + \emptyset_2 INF_{t-1} + e_{1t} \quad (1)$$

For the short-run behaviour of the variables, the error correction version of ARDL model is as follows:

$$\Delta FDV_t = \delta_1 + \sum_{j=0}^{p} \delta_2 \Delta INF_{t-1} + wECM_{t-1} + \in_t \quad (2)$$

The first part of equation (1) β and γ represents the short run dynamics of the model where as the second part with $\emptyset s$ represents the long run relationship. The null hypothesis of nocointegration in the long run relationship is defined by $H_0: \emptyset_1 = \emptyset_2 = 0$, is tested against thealternative of $H_1: \emptyset_1 \neq \emptyset_2 \neq 0$ by means of F-test. However, the asymptotic distribution of this F-statistic is non-standard irrespective of whether the variables are I(0) or I(1).

Testing Procedures

The ARDL model testing procedure starts with conducting the bound test for the null hypothesis of no cointegration. The calculated F-statistic is compared with the critical value tabulated by Pesaran & Pesaran (1997) or Pesaran et al., (2001). If the test statistic exceeds the upper critical value, the null hypothesis of no long-run relationship can be rejected regardless of whether the underlying orders of integration of the variables are zero or one. Similarly, if the test statistic falls below a lower critical value, the null hypothesis is not rejected. However, if the sample test statistic falls between these two bounds, the result is inconclusive. When the order of integration of the variables is known and all the variables are I(1), the

decision is made based on the upper bound. Similarly, if all the variables are I(0), then the decision is made based on the lower bound.

Data & Variable Information

The sample consists of monthly observations on inflation measured by CPI (logcpi), financial development is represented by credit extended to the domestic private sector (CAP) (logcap), and monetary aggregates (M2) (logm2). A monthly sample from 2007:M1 to 2016:M12 is used in this study. All variables are measured as natural logarithms, so that their differences approximate growth rates. Data on the variables are from the statistical publications of South African Reserve Bank.

Empirical Results and discussion

Tests of the Unit Root Hypothesis

The standard Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests are used to test the time series properties of the variables being investigated. The results of the unit root test are reported in Table 1. Based on the probability values, it was found that all the series are non-stationary at levels. Nevertheless, the tests yielded a conclusion after first differencing, that all series are stationary at I(1).

Table 1. Unit Root Test

Variables	ADF		PP	
	P-Value at level	P-Value at 1st Difference	P-Value at level	P-Value at 1st Difference
logcap	0.8004	0.0000*	0.7303	0.0000*
Logm2	0.2192	0.0000*	0.0238	0.0000*
logcpi	0.1091	0.0000*	0.2249	0.0000*
* denotes the rejection of null hypothesis at 5 percent level of significance				

Lag Length Selection Criteria

The choice of optimal lag length of the variables of interest is important in econometric model estimation. This is important to avoid spurious rejection or acceptance of estimated results. If the lag length is too large, the model is more likely to pick-up within sample random variation as well as any systematic relationship, because there is the need to estimate great number of parameters. If there are n- variables with lag length k, for instance, it is necessary to estimate n(nk+1) coefficients. The lag length also influences the power of rejecting hypothesis. For the purpose of any study, the optimal lag length suggested by Akaike Information Criteria (AIC), Schwarz Information Criterion (SC), Hannan–Quinn Criterion (HIQ), and Final Prediction Error could be picked. This is because all these criteria can produce conflicting lag length. The result of lag length selection shows all the selection criteria except sequential modified LR test statistic suggest lag 1, therefore a model of 1 lag is estimated.

Bound Testing (Cointegration Results)

The Bound testing cointegration result is presented in Table 2. According to Pesaran et al., (2001), the computed F-Statistic should be compared with lower bound and upper bound value at chosen significant level. From the empirically obtained results, the computed F-Statistic which is 5.45, is more than the upper bound value (4.85) at 5% significant level. Hence, the null hypothesis of no cointegration is rejected. The study concludes that there exists a long run relationship between the variables under consideration.

Table 2. Bound Testing Results

The estimated F-Statistic: 5.45		
Critical Value	**Pesaran *et al.*, (2001) Table Values**	
	Lower Bound Value	Upper Bound Value
1%	5.15	6.36
5%	3.79	4.85
10%	3.17	4.14

Long run Analysis

Equation (3) presents the results of the long-run relationship between the variables. The results show that there is significant and positive long-run relationship between inflation and credit allocated to private sector as a measure of financial development. The results also show that there is insignificant long-run positive relationship between money supply and credit allocated to private sector. The existence of a long-run relationship between inflation and credit to private sector is consistent with majority of empirical studies (Gao et al., 2012, Akinkoye et al., 2015; Lee and Wong, 2005).The positive relationship between inflation and credit to private sector in South Africa is possible because the prevailing nominal interest rate in the economy is higher than the inflationary trend and thereby ensuring the positivity of real interest rate. As long as real interest rate is positive, more credit would be allocated to the private sector. However, in an economy, where the nominal interest rate is higher than prevailing interest rate, credit allocated to private sector would be hampered.

$$logcap = 4.7 + 1.631logcpi + 0.013logm2 \quad (3)$$

Short- run Relationship and error correction model (ECM) results

Consequent upon the presence of a long-run relationship between the variables, the determination of the existence of short-run relationship among the variables is estimated. Error correction term gives the speed of the short-run adjustment. The empirical result of short-run relationship is shown in Table 3. The error correction term (-0.2473) is negative and significant meaning that there is at least a long-run causality running from the independent variables to dependent variable. It also confirms that all the variables are cointegrated or have long-run relationships. This finding supports other empirical studies in the literature (Hassan and Bashir, 2003;

Al-Awad and Harb, 2005; Chuah and Thai, 2004; Gao et al., 2012). The value of error correction term also implies that 24% of disequilibria from the previous month's shock converge back to equilibrium. The results further show that inflation has significant positive impact on credit allocation to private sector as a measure of financial development in the short run. While money supply is also found not to be significant in the short run.

Table 3. Short-Run Relationship and Error Correction model (ECM) results

Variable	Coefficient	Std. Error	t-Statistic	Prob
D(LOGM2)	0.0033	0.0061	0.5434	0.5879
D(LOGCPI)	0.4034	0.1083	3.7231	0.0003*
CointEq(-1)	-0.2473	0.0640	-3.8597	0.0002*
* denotes the rejection of null hypothesis at 5 percent level of significance				

Granger causality and ARDL causality tests results

Table 4 displays the result of the Granger causality test. The results show that there exists a unidirectional causality from inflation to credit allocated to private sector. Also, a unidirectional causality runs from money supply to inflation. This empirical evidence is however in contrast with Akinkoye et al., (2015). The evidence of causality supports other empirical findings such as Daferighe & Charlie (2012), Hassan & Bashir (2003) and Boyd, Levine & Smith (2001) among others.

Table 4. Pairwise Granger Causality results

Null Hypothesis	Chi-Sq	Prob	Direction of Causality
LOGM2 does not Granger Cause LOGCAP	0.11620	0.7338	No causality
LOGCAP does not Granger Cause LOGM2	0.39695	0.5300	No causality
LOGCPI does not Granger Cause LOGCAP	15.4476	0.0001	LOGCPI→LOGCAP
LOGCAP does not Granger Cause LOGCPI	0.92325	0.3386	No causality
LOGCPI does not Granger Cause LOGM2	0.14113	0.7079	No causality
LOGM2 does not Granger Cause LOGCPI	5.53910	0.0204	LOGM2→LOGCPI
* denotes the rejection of null hypothesis at 5 percent level of significance			

Table 5 displays the result of ARDL causality test. ARDL causality test is superior to conventional Granger causality within the framework of ARDL analysis. The ARDL causality gives the understanding of causal relations between variables in three different economic time- horizon. The result shows that inflation causes financial development in the short-run, long-run and strong-run. Evidence of money supply causing financial development in the short run could not be established. Meanwhile, evidence of money supply causing financial development is found in both long-run and strong-run.

Table 5. ARDL Causality

Variable	Short Run	p-value	Long Run	p-value	Strong Run	p-value
LOGCPI	13.8620	0.00020*	14.8973	0.00010*	9.60151	0.00190*
LOGM2	0.29538	0.58680	14.8973	0.00010*	14.0300	0.00020*
* denotes the rejection of null hypothesis at 5 percent level of significance						

Diagnostic Test

The stability of the long run coefficient is tested by the short run dynamics. Once the ECM model has been estimated, the cumulative sum of recursive residuals (CUSUM) test is applied to assess parameter stability (Pesaran and Pesaran, 1997). Fig. 1 plots the results of the CUSUM and test. The results indicate the absence of any instability of the coefficients because CUSUM statistic falls inside the critical bonds of the 5% confidence interval of parameter stability.

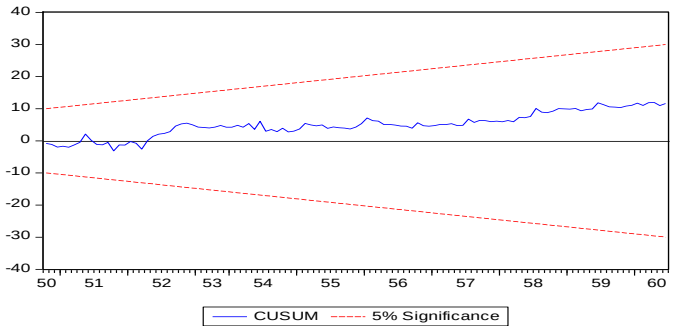

Figure 1. Plot of CUSUM test

Also, Table 6 shows that there is absence of serial correlation and heteroscedasticity. The null hypothesis of serial correlation and Heteroscedasticity were rejected because of the insignificance of the probability values as they are greater than 5 percent. However the null hypothesis of normality distribution was not rejected. This however does not affect the stability of the model as suggested by CUSUM stability test.

Table 6. Diagnostic test results

Item	Applied Test	P-Value	Decision
Serial Correlation	LM Test	0.9176	No serial correlation
Normality	JacqueBera	0.0106	Variables not normally distributed
Heteroscedasticity	Breusch Pagan Godfrey	0.1386	No Heteroscedasticity

Conclusion

This paper examines the dynamic causal relationship between inflation and financial development in South Africa, using monthly series on CPI, credit allocated to private sector and monetary aggregates (M2) 2007-2016. An ARDL model to cointegration to investigate the existence of long run relationship among the specified variables, and Granger causality to examine the direction of causality between the variables. This study merits special attention due to the possible interrelationship among the variables with implications for financial sector development. The results show that there is cointegration among the variables specified in the model when credit allocated to private sector is the dependent variable. Inflation and monetary aggregate (M2) promote allocation of credit to private sector in South Africa in the long-run. The results indicate there that there is significant Granger causality from inflation to credit allocated to private sector as a measure of financial development. Also, unidirectional causality is also found from monetary aggregate (M2) to inflation. Turning to the Granger causality test results for money supply and credit allocated to private sector, empirical results suggest that there is no significant Granger causality from money supply to credit allocated to private sector or from credit allocated to private sector to money supply. ARDL causality result shows that inflation significantly causes financial development in short-run, long-run and strong-run. Money supply is found also to significantly cause financial development only in the long-run and strong, as causality could not be found in the short-run.

Even though there is widespread belief that inflation negatively affects financial development, the empirical results fail to confirm this. Inflation is found to be a positive driver of financial development in South Africa. The major implication from these findings is that moderate level of inflation promotes investment and hence increased demand for credits by private investors. The lenders would not be unmotivated to grant increased credit demand as long as nominal interest rate is above the inflation level in the economy. It should however be taken into account that the research referred to only South Africa a developing country. Possibly, the input to the analysis concerned the period of intensified economic development of South Africa hence the formulated conclusions do not confirm the negative impact of inflation on the financial system. Therefore, to confirm the presented results, one should extend the study to other countries or extend the research period. The study concludes that management of financial system must be conducted in a manner that would motivate a stable and a moderate increase in price levels.

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ZWIĄZEK MIĘDZY ZMIANAMI W INFLACJI A ROZWOJEM FINANSOWYM

Streszczenie: Związek między inflacją a rozwojem finansowym pozostaje ważnym zagadnieniem w literaturze empirycznej i teoretycznej, ale nie poświęcono tematowi temu znacznej uwagi badawczej. W niniejszym artykule Autorzy analizują wspomniana problematykę w Republice Południowej Afryki, stosując podejście testowania granic (ARDL) do kointegracji przy użyciu miesięcznych serii w okresie od 2007 do 2016. Testy granic sugerują, że zmienne są powiązane w dłuższej perspektywie, gdy środki przydzielone do sektora prywatnego są zmienną zależną. Związana z tym korekta równowagi jest również znacząca, co potwierdza istnienie związku długotrwałego. Wyniki wskazują na znaczącą zależność przyczynowości Grangera i ARDL między inflacją i kredytami przyznanymi sektorowi prywatnemu jako miarę rozwoju finansowego. Badania empiryczne sugerują, że umiarkowany wzrost poziomu cen będzie motywował do rozwoju finansowego w RPA. Stąd w badaniu stwierdza się, że zarządzanie systemem finansowym musi być prowadzone w sposób, który motywowałby umiarkowany wzrost poziomu cen.
Słowa kluczowe: alokacja kredytów, rozwój finansowy, inflacja, zarządzanie, ARDL, RPA.

通貨膨脹變化與金融發展的關係

摘要:通貨膨脹與金融發展的關係仍然是經驗和理論文獻中的一個重要問題，但尚未得到重大的研究關注。本文通過對2007-2016
年期間的月度系列數據應用邊界檢驗（ARDL）方法，對南非的這一問題進行了檢驗。邊界檢驗表明，當信貸分配到私營部門是因變量。相關的均衡修正也很重要，這證實了長期關係的存在。結果顯示，從通貨膨脹到分配給私營部門的信貸，作為衡量金融發展的重要格蘭傑因素和ARDL因果關係。實證結果意味著價格水平的溫和上漲將激勵南非的金融發展。因此，研究認為，金融體系的管理必須以促使價格水平適度上升的方式進行。
關鍵詞:信貸配置，金融發展，通貨膨脹，管理，ARDL，南非。