The relation between Financial Innovation and Economic Growth in Algeria: ARDL approach

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Abstract :

This study investigated the impact of Financial Innovation on Economic growth in Algeria using Autoregressive distributed lag model covering the period from 1964 to 2019. Financial innovation represented by Domestic Credit to the Private Sector (DCP) and economic growth represented by GDP, an intermediate variable was used represented by Broad-to-Narrow Money (BNM).

The results indicated that Financial Innovation have significant positive impact on economic growth in both the long-run and the short-run period, also results show that variables are Co-integrated by using ARDL method.

Résumé :

Cette étude a examiné l'impact de l'innovation financière sur la croissance économique en Algérie à l'aide d'un modèle à décalage distribué autorégressif couvrant la période de 1964 à 2019. L'innovation financière représentée par le crédit intérieur au secteur privé (DCP) et la croissance économique représentée par le PIB, une variable intermédiaire a été utilisé représenté par Broad-to-Narrow Money (BNM).

Les résultats ont indiqué que l'innovation financière a un impact positif significatif sur la croissance économique à la fois à long terme et à court terme, les résultats montrent également que les variables sont co-intégrées en utilisant la méthode ARDL.

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1- The introduction:

A discussion on Financial Innovation and its impact on development and improvement can be followed to the perspective on Schumpeter (1934). He was quick to give us a thought of the association between advancement execution of an economy and the working of its credit and capital business sectors. A decent comprehension of the connection between money, advancement, and development starts with understanding the personality of advancement. (Mazzucato, 2011) (Monetary development is seen to be key ordinarily. It has esteem if its supportability can be guaranteed in the monetary area (L.A.Costanzo And Al, 2003, p 263).

Financial Innovation creating expanded monetary movement in most African nations through advancing financial consideration, portable cash moves and empowering settlements, which, thusly, affect monetary development. Generous advancement has been made in the course of recent a very long time as far as financial consideration and financial development, just as cross-line banking in Algeria financial frameworks (Beck And Al, 2015, p6). Financial Innovation presents openings for financial area development in the world in spite of the mainland having the most exceedingly awful degrees of financial access on the planet (Napier, 2010, P28)

Since the Industrial Revelation in 1760, the world wide economy development and human expectations for everyday comforts expanded quickly, yet to the detriment of weakened climate. Burning-through enormous carbon energy and disregarding outflow of contaminations lead to assets deficiency, genuine contamination and environmental crumbling, accordingly threating long haul monetary development. In 1987, the meaning of 'economical advancement' was first and foremost proposed in the Brundtland Report, targeting addressing the requirements of people in the future just as the necessities of present age. Economical improvement is the getting sorted out guideline for meeting human advancement objectives while simultaneously supporting the capacity of normal frameworks to give the regular assets and environment administrations whereupon the economy and society depend.

Banks and cell phone organizations in the world have been occupied with advancement that an affects definitely a greater number of individuals on that mainland than traditional microfinance. Aside from the financial progression carried out during the '80s and '90s, Algeria nations have persistently been changing their financial areas, obliging advancements like micro finance, portable cash and Mobile Banking to improve financial consideration. (J MOYO and AL, 2014, p14)

Financial innovation expands economic activities through promoting financial inclusion, facilitating a financial transaction in international trade,

enabling remittance and uplifting financial efficiency, which eventually play a fundamental role in economic growth.

The study problem is embodied in the following main question: Is there a long- and short-term relationship between financial innovation and economic growth in Algeria during the period 1964-2019?

This paper is a contribution to the empirics of financial innovation and economic growth and development in Algeria. Although a substantial amount of academic research has been devoted to financial development and growth nexus, the overall effects of financial innovation on growth and development are not conclusive. The paper examines the effect of financial innovation on economic growth. This is based on the realization that effective competition in the banking industry can increase the level of financial innovation, reduce the cost of financial intermediation, improve delivery of high quality services and enhance consumers' welfare (Simpasa, 2013, p789). Competition can be seen as a stimulus to increase downward pressure on costs of services or products, reduce managerial laziness and even improves the level of technology and financial innovation. (Nickell, 1996, p729) . Thus, competition may have the desirable effect of stimulating technological research and development. It forces producers to innovate constantly in order to be efficient and effective in the production of higher quality products and minimize costs to maintain or increase their market share and make more profit (Ajide & Ajileye, 2015, p6)

Utilizing the Autoregressive Distributed Lag (ARDL) Model, the examination connects an information hole in regards to the connection between financial innovation and monetary development in Algeria. Likewise, board Granger causality tests exactly test causality between financial development and monetary development in Algeria.

2- Theoretical framework of Financial innovation and economie growth :

financial innovation has transformed and restructured financial services and its impact on economies is becoming increasingly noteworthy. The World Economic Forum (2012) contends that 'leapfrog' (financial) innovation is a driving force for broader economic growth. High growth rates in Southern African countries in recent years have been sustained by natural resources and agriculture on the back of improved macroeconomic management (Mlachila and AL, 2013); there has not, however, been any mention of growth linked to finance. Thus far, the literature suggests that financial innovation drives economic growth (Levin, 1997, p689); however, the extent to which high growth rates registered by Algeria countries are driven by financial innovation, had not been specified as yet. There is no specific

study known to the authors that has attempted to establish the relationship between financial innovation and economic activity in Algeria region.

Financial innovation is defined as the creation or modification of a product, service or financial market. Financial innovations constitute a vast and heterogeneous set in which it is advisable to distinguish radical innovations from incremental innovations, a very large part of innovations is of an incremental nature, because most often, financial innovations are obtained thanks to a simple modification to the margin of some initial product characteristics. (Hao and Hunter, 1997, p64)

Financial innovation contains mechanical advances that facilitate admittance to data, exchanging and method for installment. It additionally alludes to the rise of new financial instruments and administrations, new types of association and more created and complete financial markets.

Financial innovation is a consequence of the longing of market members to set up new and efficient methods of expanding profits while giving labor and products (V.Bilyk, 2006, p 32). Lewis and Mizen (2000) partner the presence of financial advancement with the changing necessities of clients, states of providers, ecological conditions, strategy conditions and technology. Financial Innovation permits cost or hazard decrease as well as an improvement in administrations. There is no concurred proportion of financial development; henceforth, specialists watch out for intermediary it with varyent factors. Laeven, Levine, and Michalopoulos (2013) clarify that financial development isn't restricted to the creation of new financial instruments, items or institutions. As indicated by these creators, financial advancement incorporates everyday financial upgrades, for example, new financial revealing methods, enhancements in information supportive of cessing and credit scoring. (Leaven and Al, 2013)

Financial innovation has been an integral component of economic activity for several millennia (Laeven and AL , 2015) . Joseph Alois Schumpeter, in his seminal work Theory of Economic Development in 1912, highlighted the crucial role of financial intermediaries in innovation and economic development (Scherer, 1986, p89).

Financial innovation is a vital piece of money related activity; for example, money related headway has achieved essential changes in the money related system through the improvement in financial organizations and changed portion structures (Boot and Marinc, 2010, p5), new things and features for existing financial pushucts and new money related establishments and financial business areas (Odularu and Okunrinboye, 2008). It has moreover accomplished changes in informal laws and moved social experiences.

Financial innovation is a vital piece of money related activity; for example, money related headway has achieved essential changes in the money related system through the improvement in financial organizations and changed portion structures (Boot and Marinc 2010, p20), new things and features for

existing financial pushucts (Sekhar 2013; Simiyu et al. 2014), and new money related establishments and financial business areas (Odularu and Okunrinboye 2009; Simiyu et al. 2014). It has moreover accomplished changes in informal laws and moved social experiences (Mwinzi 2014; Wachter 2006; Chou and Chin 2011)

Beck et al. (2014) found that financial innovation is linked to increased growth volatility in industries that rely on external financing and innovation. The Global Financial Crisis of 2007 was focused on financial innovation, according to Allen (2012) and Llewellyn (2009). According to Allen (2012), securitization and sub-prime mortgages are inextricably linked.

The relation between financial innovation and economic growth has less empirical evidence. In Spain, Valverde, Del Paso, and Fernández (2007) discovered a positive link between product and service innovations and regional GDP, investment, and gross savings. Laeven, Levine, and Michalopoulos (2015) established a model in which financial and technological entrepreneurs work together to achieve their goals.

There are only a few empirical studies on the relationship between financial innovation and economic growth for African countries. Idun and Aboagye (2014) found that a negative relationship exists between financial inno-vation and economic growth in Ghana, in the long run, and a positive relationship in the short. Their results also show bidirectional Granger causality between financial innovation and economic growth. Mwinzi (2014) in a study on Kenya, established that financial innovation has a significant, positive impact on economic growth, with mobile transactions having a major impact.

Early attempts to explain a finance-growth nexus can be found in Bagehot (1873), Schumpeter (1912), Gurley and Shaw (1955), Goldsmith (1969), and McKinnon (1973). Financial systems can affect savings-investment decisions and growth through acquiring and processing information about possible investment projects and entrenching constructive corporate governance; trading, diversification, and management of risk; mobilizing and pooling of savings, and facilitating the exchange of goods and services (Levine, 2005).

Furthermore, a number of studies have empirically proved that the financial market promotes growth (Levine & Zervos, 1998; Rousseau & Wachtel, 2000 ; Calderon & Liu ,2003; Caporale, Howells & Soliman, 2004; Ajide & Lawanson, 2012). Other studies have also investigated the effect of competition on growth (Bikker & Groeneveld, 2000; Bikker & Haaf, 2002; Schaeck & Clhak, 2010; Ajide & Aderemi, 2015) . They hinted that the industry intermediates large portions of capital flows and household savings in developing economies; which is based on the fact that the industry

constitutes the primary source of business finance in developing countries. Healthy and effective banking competition is necessary because the absence of this condition can lead to a potential break-down in the financial system which can yield contagious effects to all other sectors of the economy (Ajide & Soyoye, 2015).

The work of Maudos and Guevara (2004) examined the effect of financial development and banking competition on economic growth using both structural measures of competition (that is, market concentration) and measures based on the new empirical industrial organization perspective (Panzar and Rosse`s test and the Lerner index). The study used the period 1993-2003 for a sample of 53 sectors in 21 countries and indicated that financial development and the exercise of bank market power promoted economic growth. This result is consistent with the literature on relationship lending which argues that banking competition can have a negative effect on the availability of finance for companies that are informationally more opaque. The results cast doubt on the use of market concentration measures as indicators of competition.

In an online discussion coordinated by The Economist on if financial development can help development, arbitrator Beddoes (2010) contended that the last not many centuries show that financial advancement is essential, without a doubt imperative, for supported monetary development and experts perity. Levine (2010), contending for the movement, made a convincing case that financial and specialized advancement are inseparably connected and develop together, recommending that financial development is fundamental for working on the abundance of countries. He added that the variation of corporate financing methods has made everything go smoothly of innovative imagination hidden monetary development. By and large, financial advancement brings about the appearance of new financial advances that upgrade the usefulness of capital, lessen exchange costs, and, consequently, animate more elevated levels of monetary development (Mishra 2008).

The existing literature suggests that the development of the financial sector has a strong association with economic growth (Asghar and Hussain 2014; Bwirea and Musiime 2015; Duasa 2014; Hye and Islam 2013; Jedidia et al. 2014; Khoutem et al., 2014; Mhadhbi 2014; Kyophilavong et al. 2016; Uddin et al., 2014a,) b). This association exists because an efficient financial system allows for the effective mobilization of economic resources with higher productivity. The idea of financial innovation is not a new one, but over the last decade, its speed has created some challenges that impact financial development, including structural changes in the financial sector, the reshaping of financial services, and the introduction of new financial assets in the financial markets. Financial innovation introduces and popularizes new financial instruments, institutions, and technologies to the

financial system (Sood and Ranjan 2015). Schumpeter (1911) emphasized the importance of well-functioning financial intermediaries in innovation and economic growth. The interactions of innovations in the financial sector create economic growth.

It has been documented that financial innovation helps to correct some kind of market inefficiency or imperfection. If markets are incomplete then financial innovation can improve opportunities for risk sharing. If there are agency conflicts, then new types of security can improve the alignment of interests. Financial innovation can lower taxes and it can avoid the effects of regulations in the financial market (Tufano, 2003). Financial innovation is good for economic growth based on the fact that such innovations will improve the allocation of capital. Due to the increasing sophistication and depth of financial markets resulting from financial innovations, it promotes economic growth by allocating capital where it can be most productive (Bernanke, 2007).

Financial innovation provides the mechanism to fund innovative technological projects when traditional sources of funds are unavailable due to high investment risk. Technological and economic progress resulting in a higher complexity of business processes and new types of risk, forces the financial system and financial markets to adapt to the changes and to be modernized according to the new requirements of the business entities and the challenges of the modern world. This leads to the conclusion that without financial innovations, technological and economic development would slow down and the wealth of nations would be lower. At the same time, the application of financial innovations would be limited without the demand arising from technical progress (Blash, 2011).

Financial innovation can assist individuals and firms to smooth expenditures in the case of temporary shortfalls in income. It may also lead to too much spending if they become over-confident. Financial innovation can increase economic uncertainties in different directions. If innovation comes with different changes in the financial system, it would have different effects on volatility. The different economic disturbances changes over time, the impact of augmenting or damping certain kinds of shocks will matter more or less in certain periods. A single type of innovation can affect households and firms differently, so one needs to aggregate the various responses (Elmendorf, 2008).

A number of different forms of financial innovations can have different effects on the money demand hence economic growth (Dunne & Kasekende, 2016). New products such as ATMs/ debit cards, and quasi-money such as financial instruments, could potentially improve efficiency and reduce transaction costs, in as much as, cash that would have been carried in

wallets is replaced by these innovations. This could lead to a decline in demand for cash. A reduction in demand for money for transaction motives could deter economic growth and output. Also, individuals move away from more liquid assets to less liquid assets. This results in a demand for less money. On the other hand, financial innovations could potentially lead to an increase in money demand if payments systems improve but individuals demand more liquid assets. For example, where individuals demand electronic money and cash through the use of mobile phone technology but do not necessarily move away from more liquid assets to less liquid assets, this action may as well increase the transaction motives thereby increasing demand for goods and services in the economy, while at the same time improving economic growth. Financial innovation is good for the economy if it enables an economically productive use of money that would not otherwise occur. It is very clear that financial innovations may not necessarily add value to an economy. This can be the case when information asymmetries are present. This can happen if information asymmetries present particular contingencies that are not contractible, having complete markets is infeasible. It may also occur when contingencies are not verifiable, and/or too costly to verify. Introducing a financial innovation might not generate a good outcome or much motivation. Financial innovations might be intended to fool market participants. Financial innovations would then tend to worsen the allocation of capital (Boot & Marinc, 2010).

A recent study by Dunne and Kasekende (2016) investigated the development of financial innovation and its impact on money demand in sub-Saharan Africa using panel data estimation techniques for 34 countries between 1980 and 2013. The results indicated that there was a negative relationship between financial innovation and money demand. This suggests that financial innovation plays a crucial role in explaining money demand in sub-Saharan Africa and can have important implications for future policy design. The factors influencing the adoption of financial innovation in Ghana's banking industry were carried out by Domeher, Frimpong and Appiah (2014). Surveys were conducted involving 405 clients of the six major banks in the country. Using logistical regression, the results showed that innovation attributes such as lack of complexity, compatibility and perceived usefulness provided by financial innovation, increase the likelihood of e-banking adoption. Anthony and Aboagye (2014) examined the relationship between bank competition, financial innovations and economic growth in Ghana using quarterly data from 1990 to 2009. They employed the ARDL co-integration procedures.

Further investigation on the effect of financial development on innovation for 51 countries between 1993 and 2008 was carried out by Meierrieks (2015) Consistent with the expectations from Schumpeterian

models of finance, entrepreneurship and economic growth it was found that higher levels of financial development coincide with stronger innovative activity. It was further stressed that financial intermediaries may indeed encourage investment in innovative entrepreneurial activity. Hao and Hunter (1997) examined the link between banking, financial system structure and economic growth, by constructing a cross-country regression model using data over the 1970–1988 periods. They extended the existing literature by explicitly examining the impact of measures of a country's financial deepness, in terms of second stage financial innovations, on a country's rate of economic growth. The results showed that financial development (e.g., as measured by the presence of an organized financial futures market—a second stage innovation) is positively correlated with enhanced economic growth.

3- Data and methodology:

The study used the annual time series data for the period 1964–2019. The data were collected and transformed from 2 sources: the World Development Indicators published by the World Bank (World Bank 2020), the World Economic Outlook published by the IMF (World Economic Outlook 2020). The research variables are positively defined in Table 1. The statistical analysis package Eviews 9.5 was used for the data analysis.

We selected the real GDP per capita as the economic growth indicator, which is widely used by researchers (Bara et al. 2016; Bara and Mudxingiri 2016; Ajide 2015; Cavenaile et al. 2011; Ndlovu 2013; Sabandi and Noviani 2015; Mwinzi 2014). If any country experienced an increasing trend in its GDP per capita over the selected time period, we assumed that that economy was growing.

Financial innovation in the economy brings about changes through the introduction of new financial instruments, institutions, services, and reporting (Laeven et al. 2015). The impact of financial innovation on the economy is diversified and no single variable can be considered as an appropriate indicator for measuring its significance in the economy. We selected 2 Proxy indicators to measure financial innovation. The first proxy for financial innovation is the Domestic Credit to the Private Sector (DCB), which refers to the ratio of the number of credit facilities to the private sector for investment in the form of securities, loan, and other accounts receivable. Growth economic theory predicts that capital adequacy will positively influence economic growth, and so we assigned this variable a positive sign for its coefficient. Using the approach found in Bakang (2016), the second proxy for financial innovation was defined as the Broad-to-Narrow Money (M2/M1) (Laeven et al. 2015; Bara and Mudxingiri 2016; Bara et al. 2016; Ansong et al. 2011).

The ARDL model is used to analyze cointegration series for long- run and short-run dynamics, even when the time-series are stationary I (0) or integrated of order I (1). The variables may include a mixture of stationary and non-stationary time-series for ARDL Bounds testing approach proposed by PESARAN, M. Hashem, 199716, (Pesaran, M. H., Shin, Y., & Smith, R. J, 2001).

The Domestic Credit to the Private Sector is a function of financial innovation function in the case of ARDL data logarithm form cans be expressed as follows:

$$DCPit = f\ (GDPit,\ BNMit\ )\ldots\ldots.(1)$$

The standard ARDL data model is as follow:

$$\Delta\ DCP_{it} =$$
$$\alpha_i + \sum_{j=1}^{m=1} B_{ij}\Delta\ DCP_{i,t} + \sum_{r=0}^{p=1} \theta_{it}\Delta\ BNM_{it} + \sum_{j=1}^{m=1} \theta_{it}\Delta\ GDP_{i,t} +$$
$$\delta_1 DCP_{it} + \delta_2 BNM_{it} + \delta_3 GDP_{it} + \varepsilon_{it}$$

Where, DCP is the Domestic Credit to the Private Sector, BNM is Broad-to-Narrow Money, GDP is Gross Domestic Product. while α i and β also indicate the individual intercepts and slope coefficients. Δ and $\in$ ki,t (k=1,2) are the first difference operators and a white noise term.

4- Results and discussion :

4-1 -Descriptive Analysis of Variables:

From Table 1 show the common sample descriptive statistics. And we deduce that the BNM distribution is approximately symmetric, whereas the DCP and GDP distributions are highly skewed. This means that the majority of the observations are spread on the right side for the last-two distributions. Also, it is shown, from the Kurtosis statistics, that the BNM distribution is approximately mesokurtic whilst the DCP and GDP distributions are leptokurtic.

The main conclusion from these shape statistics is that we cannot assert that all these distributions are normal. This is confirmed by the Jarque–Bera test where there is great evidence that the normality null hypothesis is accepted for BNM and rejected for GDP, DCP these distributions.

Table 1: Common sample descriptive statistics

	DCP	GDP	BNM
Mean	29.89397	7.16E+10	59.78632
Median	22.29378	4.94E+10	59.50113
Maximum	69.31185	2.14E+11	83.82403
Minimum	3.907417	2.91E+09	33.00584
Std. Dev.	21.73493	6.36E+10	14.10329
Skewness	0.522500	0.935789	-0.178811
Kurtosis	1.773093	2.613838	2.182661
Jarque-Bera	6.060425	8.521157	1.857186
Probability	0.048305	0.014114	0.395109

Source : prepared by researchers based on the Eviews10.0 program.

4-2 -Unit Root Tests for the Variables:

Before presenting empirical results of the (ARDL) model, we have to check the order of integration of our variables. We want them to be stationary, because non-stationarity leads to spurious results, since test statistics (t and F) are not following their usual distributions and thus standard critical values are almost always incorrect .we apply the following econometric steps of the stationary and non-stationary Tests of the time series data by Augmented Dickey-Fuller (ADF) and Phillips- Perron (PP).

The Augmented Dickey-Fuller (ADF) test and Phillips- Perron (PP) results for the time series variables are presented in Tables (2) below.

Table 2 : Stationarity tests for the study variables.

| variables | ADF | | | | | | Results |
	At level			At First Difference			
	NON	Intercept	Trend&Intercpt	NON	Intercept	Trend&Intercpt	
BNM	0.657	-1.810	-1.879	-5.848	-5.891	-5.842	I(1)
	0.855	0.371	0.651	0.000	0.000	0.000	
DCP	-0.538	-1.224	-1.955	-5.608	-5.556	-5.525	I(1)
	0.479	0.657	0.611	0.000	0.000	0.000	
GDP	1.124	-0.289	-5.405	-6.452	-6.742	-6.707	I(1)
	0.930	0.919	0.912	0.000	0.000	0.000	

Source : prepared by researchers based on the Eviews10.0 program.

   According to the table2, results of level stationarity tests in the three models indicate that all-time series are non-stationary at level, where the probability of these tests in most models was greater than the significance level of 5%. After using stationarity tests at the first differences, Results indicate that all other time series are stationary type I(1) in all models.

The stationarity of time series types I(0) and I(1) makes a possibility of existence of a cointegration relationship between these time series. In this case, ARDL models are a modern approach for addressing the problem of cointegration between non-stationary and integrated time series types I (0) or I (1) developed by Pesaran and al (2001), which combines autoregressive models, AR(p) and Distributed Lag models, that depends on OLS estimation method. Therefore, the dependent variable is a function of its time-lag values and the values of the current and past explanatory variables with certain of lag period .

The criterion for variables lag order selection is presented in the following graph. On the basis of the Akaike Information Criterion (AIC). the optimal lag length has been selected. According to the AIC, among the top 20 model our best model for this study is ARDL (2, 2,0) model.

Figure 1: Akaike Information Criterion (AIC) lag selection

Akaike Information Criteria (top 20 models)

Source : Eviews10.0 program.
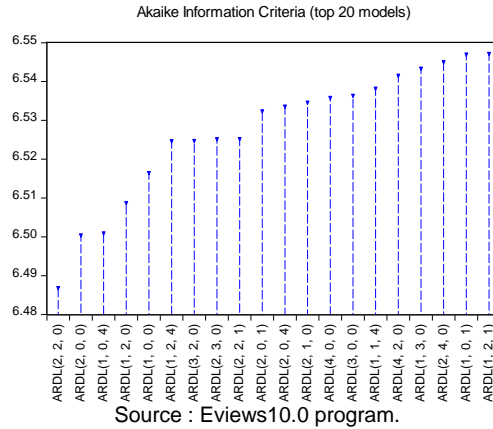
4-3- Cointegration test (Bounds Test):

This test is based on the following hypothesis test, Accepting the null hypothesis means no cointegration relationship between the variables of the study (long-term equilibrium relationship), As for the accepting of the alternative hypothesis, means that there is a cointegration relationship, this test is performed by comparing the calculated Fischer statistic with the critical values proposed by Pesaranand al (2001), if it is: Fcal $\geq$ Fupper critical the null hypothesis is rejected and the alternative hypothesis is accepted, i.e. there is a cointegration (long-term relationship); Fcal$\leq$ Flower critical the null hypothesis is accepted (no cointegration); however, if it is found that: Flower critical $\leq$ Fcal $\leq$ Fupper value in this case the test is considered to be undetermined (zone of doubt).

Table 3 : Results of the Bounds Test.

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif	I(0)	I(1)
F-statistic	6.191845	10%	3.17	4.14
k	2	5%	3.79	4.85
		2.5%	4.41	5.52

Source : prepared by researchers based on the Eviews10.0 program.

Based on the results from the table2, we find that Fcal $\geq$ Fupper critical at various degrees of significance, and therefore we reject the null hypothesis and accept the alternative hypothesis which means that there is a cointegration relationship (long-term equilibrium relationship).

4-4- Estimation Results of the coefficients in Long-Term :

The estimation results of cointegration relationship showed in the table below through the probability corresponding of Student's statistic that most of the coefficients were significantly different from zero in the long run at the significance level of 5%.

Table 4 : Results of estimating long-term.

Dependent Variable: DCP

Method: ARDL

Selected Model: ARDL (2, 2, 0)

Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DCP(-1)	0.959169	0.137388	6.981453	0.0000
DCP(-2)	-0.202307	0.120255	-1.682319	0.0991
GDP	-5.80E-11	6.20E-11	-0.936080	0.3540
GDP(-1)	9.91E-11	9.11E-11	1.088102	0.2821
GDP(-2)	-1.30E-10	6.32E-11	-2.061339	0.0448
BNM	0.459364	0.116986	3.926673	0.0003
C	-14.35005	4.730811	-3.033317	0.0039
R-squared	0.940219	Mean dependent var		30.38899
Adjusted R-squared	0.932587	S.D. dependent var		21.98064
S.E. of regression	5.707052	Akaike info criterion		6.441705
Sum squared resid	1530.811	Schwarz criterion		6.699536
Log likelihood	-166.9260	Hannan-Quinn criter.		6.541140
F-statistic	123.2000	Durbin-Watson stat		2.013859
Prob(F-statistic)	0.000000			

*Note: p-values and any subsequent tests do not account for model
selection.

Source: prepared by researchers based on the Eviews10.0 program

According to the AIC an ARDL (2,2,0) model is selected in this study.
Long-run estimated coefficient of ARDL is presented in Table 4. The
estimated coefficient of DCP, GDP and BNM is -0.20, -1.30 and 0.45 which
is significant at 10% and 5 %level. DCP coefficient suggests that nominal
DCP Decline by 30 basis point due to 1 unit change in GDP and BNM rises
by 45 basis point.

4-5- Results of Estimating Error Correction Model:

Since the results of the bound test confirmed the existence of a cointegration
relationship between the variables long-term relationship, so we can
estimate the short-term relationship using ARDL test the results of
estimating this model are summarized in the following table.

Table 5 : Results of estimating short-term

ARDL Error Correction Regression
Dependent Variable: D(DCP)
Selected Model: ARDL(2, 2, 0)
Case 3: Unrestricted Constant and No Trend
Sample: 1964 2019
Included observations: 54

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-14.35005	3.330688	-4.308434	0.0001
D(DCP(-1))	0.202307	0.115001	1.759172	0.0851
D(GDP)	-5.80E-11	6.04E-11	-0.961653	0.3411

D(GDP(-1))	1.30E-10	6.07E-11	2.145669	0.0371
CointEq(-1)*	-0.243138	0.055250	-4.400680	0.0001
R-squared	0.364637	Mean dependent var		0.144248
Adjusted R-squared	0.312771	S.D. dependent var		6.742359
S.E. of regression	5.589368	Akaike info criterion		6.367631
Sum squared resid	1530.811	Schwarz criterion		6.551796
Log likelihood	-166.9260	Hannan-Quinn criter.		6.438656
F-statistic	7.030319	Durbin-Watson stat		2.013859
Prob(F-statistic)	0.000148			

* p-value incompatible with t-Bounds distribution.

Source: prepared by researchers based on the Eviews10.0 program

Through the results of the estimation in Table (5), the determination coefficient indicates that 36, 46% of the output fluctuations are explained by independent variables in the model. It was also found through the corresponding probability of Student's statistic that the Error Correction Term ECT coefficient is very significant, where the probability is (Prob = 0.0001), so it has a negative sign, which confirms the existence of a long term equilibrium relationship between the variables of the study (cointegration relationship), It's equal to (-0.2431), and it indicates the amount of real GDP fluctuation and DCP due to the deviation of the value of independent variables in the short term from their long-term equilibrium values by one unit.

The error correction term indicates that output fluctuation corrects its remaining equilibrium value from each past period about (24.31%), this means that in the short term, the relationship between the output and the rest of the explanatory variables integrated in the estimated model may be unbalanced, when the output deviates during the short term in the period (t-1) from its equilibrium value in the long run, the equivalent of (24.31%) of this deviation is corrected in the period (t). On the other hand, this correction ratio reflects a very high adjustment speed towards equilibrium. In the short term, the independent variables in the model do not affect the output fluctuation, with the exception of real GDP D(GDP (-1)), which was significant and affected DCP in the opposite direction. In other words, decreasing the real GDP with a single lag period (t-1) increases the fluctuations in output in the subsequent period t.

5-Test the validity of the estimated model:

We test the validity of the estimated model through the following statistical tests:

5-1- Test of Normal distribution of residuals:

Through the appendix3, we find that the probability corresponding to the Jaque-Bera test (Prob = 0.000) is less than the level significance of 5%, so the residual follows the normal distribution.

Figure 2: Test of Normal distribution of residuals
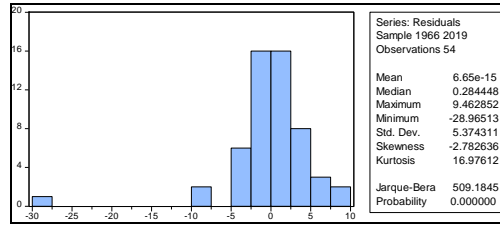
Source : Eviews10.0 program.

5-2- Test the Heteroscedasticity:

According to both appendix4 and appendix5, we find that the probability corresponding to the ARCH test and Breusch-Pagan Godfrey test were Prob=0.9243 and Prob =0.9852 respectively, it was greater than the level significance of 5%, and therefore we accept the null hypothesis which means that the error variances are all equal, and this is good for the model and the results.

Table 6 : Test the Heteroscedasticity

Heteroskedasticity Test: ARCH			
F-statistic	0.078844	Prob. F(2,49)	0.0443
Obs*R-squared	0.166806	Prob. Chi-Square(2)	0.0400

Source: prepared by researchers based on the Eviews10.0 program

5-3- Error autocorrelation test:

Using the Breusch-Godfrey Serial Correlation LM test we found that the corresponding probability of this test is greater than the significance level of 5%, so we reject the null hypothesis that refers to no autocorrelation.

Table 6 : Test the autocorrelation

| Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.014910	Prob. F(2,45)	0.9852
Obs*R-squared	0.035759	Prob. Chi-Square(2)	0.9823

Source: prepared by researchers based on the Eviews10.0 program

5-4- Test for structural stability of the model:

For the purpose to test the structural stability of the estimated model coefficients, we use the cumulative sum test of the recursive residual (CUSUM). As the structural stability of the estimated coefficients for the formula of the error correction equation is achieved if the graph of the CUSUM statistic falls within critical bounds at a significance level of 5%. The coefficients are unstable if the graph of the previous two statistics move outside critical bounds.

Through the results of this test, it is clear that the model is characterized by stability in most of the study periods, where the graphic form occurred within the critical bounds at the significance level of 5%. So, the model

parameters are structurally stable and there is no structural change in them as shown in the figure below.

Figure 2: test for structural stability of the model
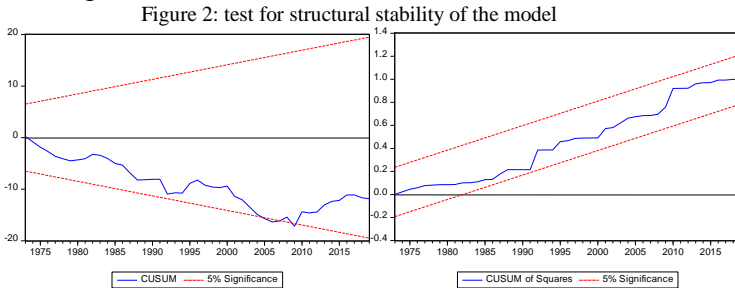
Source: prepared by researchers based on the Eviews10.0 program

6- Conclusion:

This study based to find a relation between financial innovation and economic growth in Algeria during the period from 1964-2019 through the use of a model ARDL method, the aim of the study was to test the long And short-term relationship between financial innovation represented by Domestic Credit to the Private Sector (DCP) and economic growth represented by GDP, an intermediate variable was used represented by Broad-to-Narrow Money (BNM).

The results of the study showed that the model coefficients of each indicator of financial innovation explained their positive contribution both in the long and short run towards economic growth. The associated probability was less than 5%, implying that it was statistically significant as well. We presumed that any initiative towards encouraging financial innovation in the financial system might have a positive influence on economic progress with efficient financial institutions, financial intermediation, and efficient allocation of economic resources; these, in turn, expedite economic growth our results were in line with those of Mwinzi (2014). Our study revealed the feedback causality between financial innovation and economic growth both in the long run and short run, implying that any shock either in the economic development process or financial development through encouraging financial innovation can produce positive development in the economy. Our results showed that financial innovation in the financial system can accelerate the economic growth of Algeria through positive improvements in financial development and the mobilization of economic resources. This is because our study found a positive and significant relationship among the M2/M1, DCB, and GDP over the period from 1964 to 2019. Financial innovation, therefore, can be a source of economic growth for Algeria.

7- References:

A. Idun, A. A. (2014). Bank competition, financial innovations and economic growth in Ghana. *African Journal of Economic and Management Studies , 5* (1), 30-51.

Allen, F. (2012). Trends in Financial Innovation and Their Welfare Impact: an Overview. *European Financial Management , 18* (4), 493-514.

Asghar, N. &. (2014). Financial Development, Trade Openness and Economic Growth in Developing Countries: Recent Evidence from Panel Data. *Pakistan Economic and Social Review , 52*, 99-126.

Beck, T. T. (2014). Financial Innovation: The Bright and the Dark Sides. *SSRN1991216* .

Bernanke, B. S. (2007, March 2). *Globalization and monetary policy.* (G. a. policy, Interprète) the Fourth Economic Summit, Stanford, Stanford Institute for Economic Policy Research, California.

Bernanke, B. S. (2007). Globalization and monetary policy. *the Fourth Economic Summit* (pp. 1-8). Stanford,California: Stanford Institute for Economic Policy Research.

Bikker, J. A. (2000). Competition and Concentration in the EU Banking Industry. *Kredit und Kapital , 33*, 62-88.

Boot, A. W. (2010). Financial innovation: Economic growth versus instability in bank-based versus financial market driven economies.

Boot, M. M. (2010). Financial innovation: Economic growth versus instability in bank-based versus financial market driven economies. *International Journal of Business andCommerce , 2* (1), 1-32.

Bwirea T, M. A. (2015). Financial Development - Economic Growth Nexus: Empirical Evidence from Uganda. *J Soc , 4* (2), 1-18.

Cardos, R. (2018). *Accounting Regulation and Regulation of Accounting: Case of Convergence to IFRS.* spain.

Chou YK, C. M. (2011). Financial Innovations and Endogenous Growth. *J Econ Manage , 25* (2), 25-40.

D Domeher, J. M. (2014). Adoption of financial innovation in the Ghanaian banking industry. *African Review of Economics and Finance , 6* (2), 88-114.

Dunne, P. J. (2016). Financial innovation and money demand: Evidence from Sub-Saharan Africa. *Economic Research Southern Africa (ERSA)* .

Elmendorf, D. (2008, April). Financial innovation and housing: Implications for monetary policy. A comment prepared for a Brookings Institution event on The Housing Crisis and Lessons for Monetary Policy, The Brookings Institution.

F Ajide, A. A. (2015). The Effects of Earnings Management on Dividend policy in Nigeria: An Empirical Note. *The suj Transactions on Advances in Space Research & Earth Exploration , 4* (4).

F Ajide, O. S. (2015). Concentration and Competition in Nigerian Banking Industry: A Review. *ICAN Journal of Accounting and Financ , 5* (1).

G Coporale, A. S. (2004). STOCK MARKET DEVELOPMENT AND ECONOMIC GROWTH: THE CAUSAL LINKAGE. *Journal of Economic Development , 29* (1), 33-50.

G. Odularu, O. O. (2009). Modeling the impact of financial innovation on the demand for money in Nigeria. *African Journal of Business Managemen , 3* (2), 39-51.

Hye QMA, I. F. (2013).) Does financial development hamper economic growth: empirical evidence from Bangladesh. *J Bus Econ Manage Sci , 14* (3), 558-582.

J Bikker, K. H. (2002). Competition, concentration and their relationship: An empirical analysis of the banking industry. *Journal of Banking & Finance , 26* (11), 2191-2214.

J Guevara, J. M. (2004). Factors Explaining the Interest Margin in the Banking Sectors of the European Union. *Journal of Banking & Finance , 28* (9), 2259-2281.

J, B. (2011). Financial Innovations And Their Role In The Modern Financial System – Identification And Systematization Of The Problem. . *Financ Internet Q e-Finance , 7* (3), 13-26.

J, D. (2014). Financial Development and Economic Growth: The Experiences of Selected OIC Countries. *Int J Econ , 8* (1), 215-228.

j.Wacheter. (2006). A consumption-based model of the term structure of interest rates. *Journal of Financial Economics , 79* (2), 365-399.

Jedidia TB, B. T. (2014). Financial development and economic growth: New evidence from Tunisia. *J Policy Model , 36* (5), 883-898.

K Ajide, O. L. (2012). Modelling the Long Run Determinants of Domestic Private Investment in Nigeria. *Asian Social Science , 8* (13), 139-152.

K Schaeck, M. Č. (2010). Banking Competition and Capital Ratios. *IMF Working Paper Monetary and Capital Markets Department* (pp. 1-42). International Monetary Fund .

K, M. (2014). Financial Development and Economic Growth: A Dynamic Panel Data Analysis. *nt J Econ Financ , 2* (2), 48-58.

Khan, M. S. (2000). Financial development and economic growth : an overview . *International Monetary Fund*, (pp. 15-18). Washington, D.C.

Khoutem BJ, T. B. (2014). Financial development and economic growth: New evidence from Tunisia. *journal of Policy Modeling , 36* (5), 883-898.

Kyophilavong P, U. G. (2016). The Nexus between Financial Development and Economic Growth in Lao PDR. *Glob Bus Rev , 17* (2), 303-317.

Levine, R. (2010). An autopsy of the US financial system: accident, suicide, or negligent homicide. *Journal of Financial Economic Policy , 2* (3), 196-213.

Levine, R. (2005). Finance and Growth: Theory and Evidence,. Elsevier.

Llewellyn, D. T. (2009). Financial Innovation and a New Economics of Banking: Lessons from the financial crisis.". *Challenges for Monetary*

Policy-Makers in Emerging Markets no. 1. . http:// citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.469.6524 &rep=rep1&type=pdf#page=23.

Mazzucato, M. (2011). The Entrepreneurial State. *Soundings* .

Meierrieks, D. (2015). Financial Development and Innovation: Is There Evidence of a Schumpeterian Finance-Innovation Nexus? *Annals of Economics and Finance , 15* (2), 61-81.

Mwinzi, M. D. (2014). The Effect of Financial Innovation on Economic Growth in Kenya. Nairobi: School of Business, University of Nairobi.

P Mishra, B. P. (2008). Financial Innovation and Effectiveness of Monetary Policy. *SSRN Electronic Journal* .

P Roussrau, P. W. (2000). Equity markets and growth: Cross-country evidence on timing and outcomes, 1980-1995. *Journal of Banking & Finance , 24* (12), 1933-1957.

R. Levin, S. Z. (1998). Stock Markets, Banks, and Economic Growth. *American Economic Review , 88* (3), 537-558.

R. Simiyu, P. N. (2014). Effect of Financial Innovations and Operationalization on Market Size in Commercial Banks: A Case Study of Equity Bank, EldoretBranch. *International Journal of Business and Social Science , 5* (8), 227-249.

Sekhar, G. S. (2013). Theorems and Theories of Financial Innovation: Models and Mechanism Perspective. *Financial and Quantitative Analysis , 1* (2), 26-29.

Sood V, R. P. (2015). Financial Innovation in India: An Empirical Study. *J Econ Bus Rev , 10* (1), 1-20.

Tufano, P. (2003). Financial innovation. *Handbook of the Economics of Finance, , 1* (1), 307-335.

Uddin KMK, R. M. ((2014a)). Causality between Exchange Rate and Economic Growth in. *Eur Sci J , 10* (31), 11-26.