Digital transformation and financial inclusion in Algeria

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Abstract:

Financial inclusion constitutes a lever for inclusive growth for developing countries. In this study, three simple regression models will be estimated to examine the relationship between digital transformation and financial inclusion in Algeria.

The results show that the number of mobile phone subscriptions positively affects financial inclusion. These results suggest a profound digital transformation involving all financial services.

Keywords: digital transformation; financial inclusion; relationship; econometric modeling; Algeria.

Jel Classification Codes: : C22, G212

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1. INTRODUCTION

Financial inclusion is today an important issue for the financial policies of developing countries. Digital financial inclusion makes financial services accessible to all economic agents. Fintech helps reduce costs and improve the speed, security, and transparency of transactions.

Studies conducted in Kenya by (Jack & Suri, 2014) and (Suri & Jack, 2016) as well as the work of (Aker, Boumnijel, McClelland, & Tierney, 2016) carried out in Niger have shown that exploiting the widespread use of mobile phones and (ICT) to make financial services accessible to all people has helped to reduce poverty.

In Algeria, digital transformation has been underway for several years and has affected various sectors. Like other institutions, banks and insurance companies are leveraging the use of mobile phones and ICTs to make digital financial services accessible to the entire population. Law No. 23-09 of June 21, 2023, relating to the monetary and banking law represents the main source of digital financial inclusion, as well as the various regulations of the Bank of Algeria, including the one mainly relating to financial inclusion. Also, the notes and instructions of the Bank of Algeria dealing with this aspect.

Given the above and the importance given to digital financial inclusion by the Algerian government, the objective of this study is to examine the link between digital transformation and financial inclusion in Algeria.

This study assumes a positive relationship between digital transformation and financial inclusion in Algeria. The empirical study was based on a regression model applied to annual data (2004-2023).

2. Digital financial inclusion: Brief literature review

Financial inclusion is recognized as essential for inclusive growth, as it offers practical solutions to remove barriers that exclude individuals from the financial sector. The digital transformation of financial services facilitates increased broadband penetration, which promotes the delivery of financial services in rural areas, provides consumers with tailored services (digital banking, mobile lending, and savings), promotes access to credit for small and medium-sized enterprises (SMEs), leads to increased efficiency of traditional financial institutions, and, more fundamentally, promotes financial inclusion (Demirgüç-Kunt, Klapper, Singer, Ansar, & Hess, 2017).

Empirically, the link between financial inclusion and economic growth has been the subject of numerous econometric studies. Indeed, Rasheed, Law, Chin, & Habibullah (2016), using "commercial bank branches per 100,000 adults and ATMs per 100,000 adults" as indicators of financial inclusion, confirmed the positive link between financial inclusion and economic growth for 97 countries between (2004-2012).

More recently, in their study, Akpa& Chabossou (2021), analyzing the effect of financial inclusion on agricultural growth in Benin over the period 1988–2018 using the OLS method, showed that financial inclusion has a positive and statistically significant effect on agricultural production.

According to a study by (Suri & Jack, 2016), conducted in Kenya, access to mobile banking services has numerous benefits, particularly for women. It has enabled female-headed households to increase their savings by more than a fifth; 185,000 women to leave agriculture and develop commercial or retail activities; and it has contributed to a 22% reduction in extreme poverty in female-headed households.

Digital financial services can help individuals manage financial risks by making it easier for them to collect money from distant friends and relatives in difficult times. In Kenya, Jack & Suri, (2014) found that mobile money users did not reduce their spending, while non-users and those with limited access to the mobile money network reduced their purchases of food and other items by 7 to 10%.

Furthermore, digital financial services can reduce the cost of receiving payments. For example, according to a study by Aker, Boumnijel, McClelland, & Tierney (2016) in Niger, beneficiaries were able to save an average of 20 hours of travel and waiting time by paying their monthly government social benefits by mobile phone instead of cash.

Digital payments can help reduce corruption and improve efficiency. Studies in India show that the leakage of pension benefits fell by 47% (2.8%) when payments were transferred using biometric smart cards rather than cash. Similarly, in Niger, distributing social transfers via mobile phone rather than cash reduced the variable cost of benefit administration by 20% (Demirgüç-Kunt et al., 2017) .

3. State of digital financial inclusion in Algeria

To assess the state of financial inclusion and digital transformation in Algeria, data from World Bank reports (World Bank, 2023) and the Global Findex database (Global Findex Database, 2023) will be used. This assessment will be illustrated by several indicators measuring the degree of adoption of ICT in financial services and the level of

accessibility of financial services to economic agents.

Fig.1. Evolution of the share of adults (+15) holding a current account in Algeria Graphical

	2011	2014	2017	2021
Account (% age 15+)	33%	50%	43%	44%
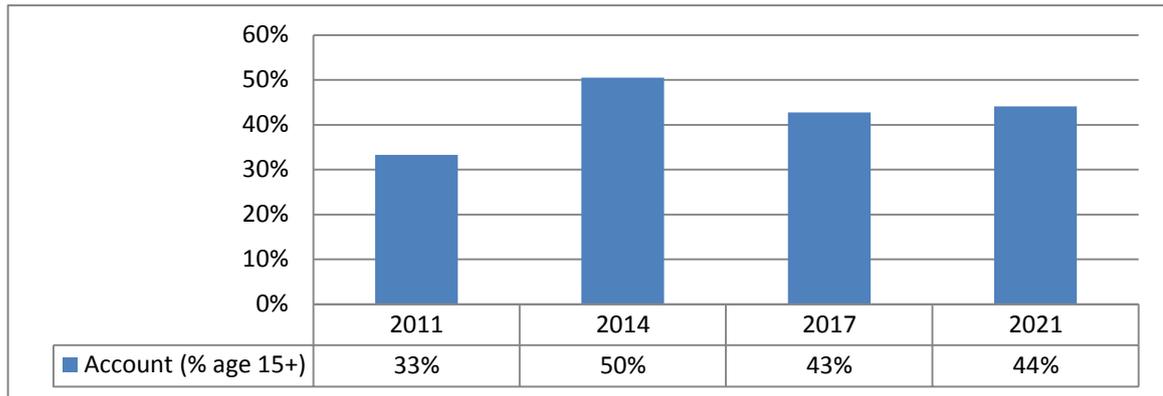
Source: Global Findex (2023)

In Algeria, according to Global Findex 2021 data, only 44% of adults had a current account in 2021 (Global Findex Database, 2023). While this rate is well above the Arab world average, it remains lower than the global average rate and that recorded in high-income countries
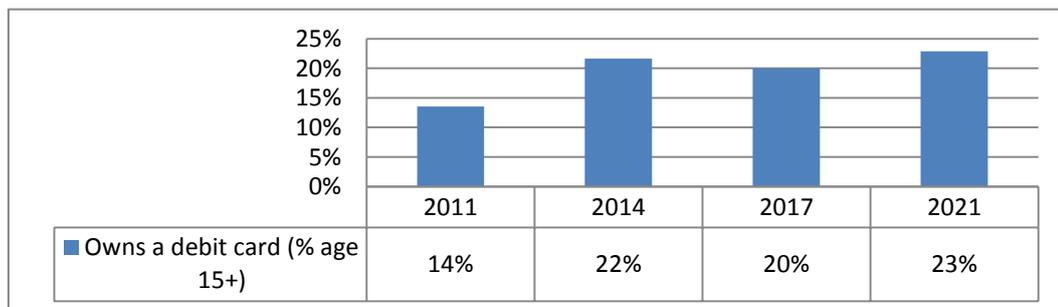
Fig.2. Evolution of the share of adults (+15) holding a credit card in Algeria

	2011	2014	2017	2021
	1%	6%	3%	3%
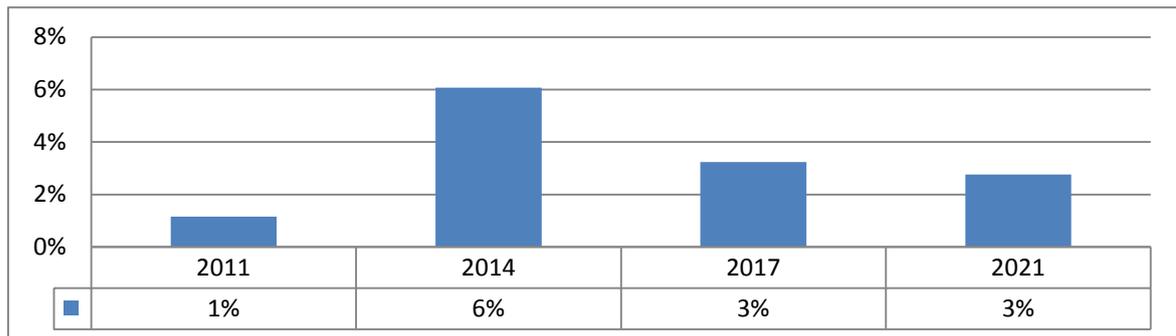
Source : Global Findex (2023)

Furthermore, according to Global Findex 2021 data, only 3% of adults have a credit card.

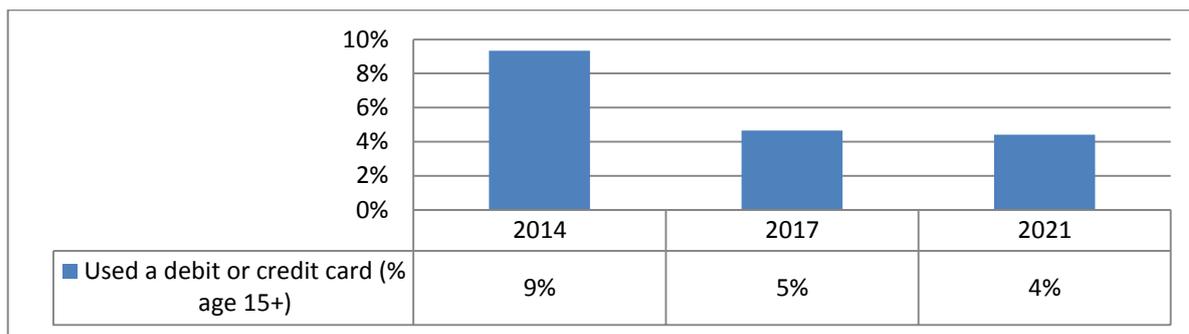Fig.3. Evolution of the share of adults (+15) holding a debit card in Algeria

	2011	2014	2017	2021
Owns a debit card (% age 15+)	14%	22%	20%	23%

Source: Global Findex (2023)

According to Global Findex 2021 data, only 23% of adults have a debit card.

Fig.4. Change in the share of adults (+15) using a debit or credit card (% aged 15 and over)

	2014	2017	2021
■ Used a debit or credit card (% age 15+)	9%	5%	4%

Source: Global Findex (2023)

In 2021, in terms of usage, only 4% of adults use a debit card in their transactions.

Fig.5. Share of adults (+15) making or receiving digital payments (% aged 15 and over)
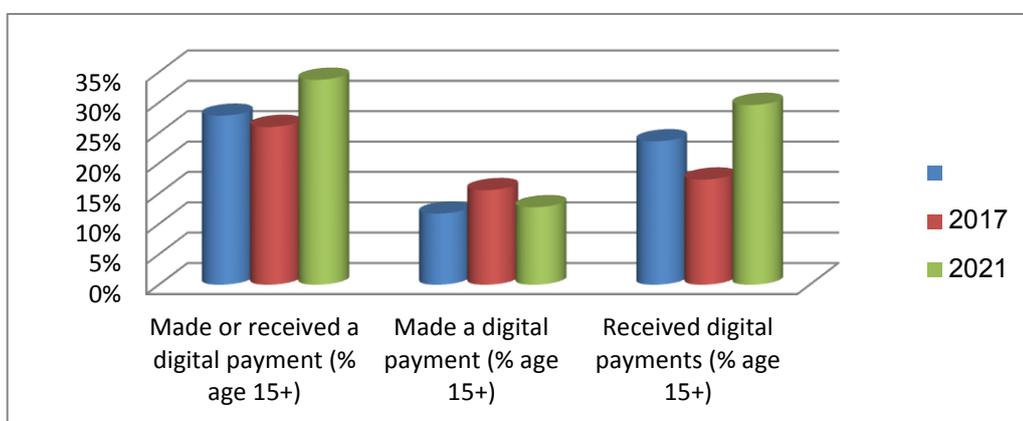
Source: Global Findex (2023)

In 2021, only 13% of adults used e-payments for their digital payments. In contrast, more than 30% of adults received their income online. Only 8% of adults used a mobile phone or the internet to pay for their online purchases. Furthermore, only 4% of adults used a mobile phone or the internet to pay for their purchases (see Figure 5).

Fig.6. Change in the share of adults (+15) using mobile phones or the internet for purchases

Source: Global Findex (2023)

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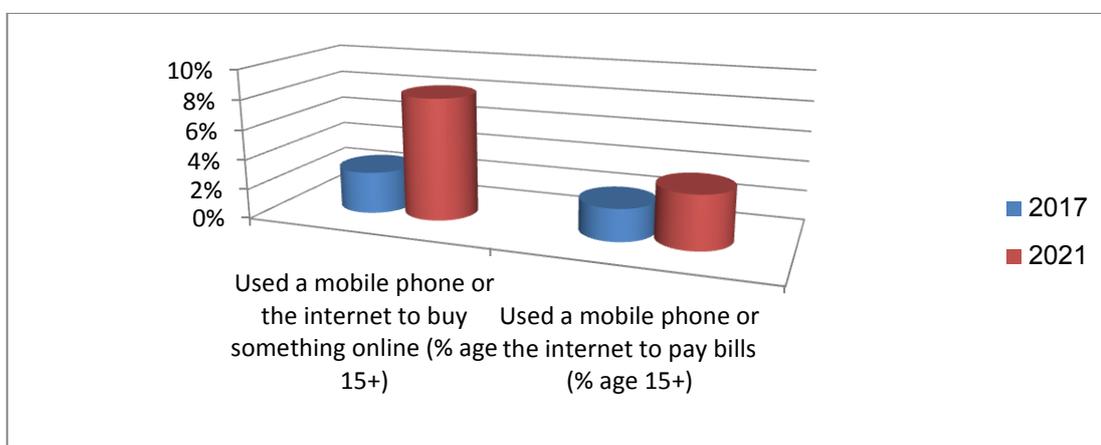
Fig.7. Evolution of some indicators of financial inclusion
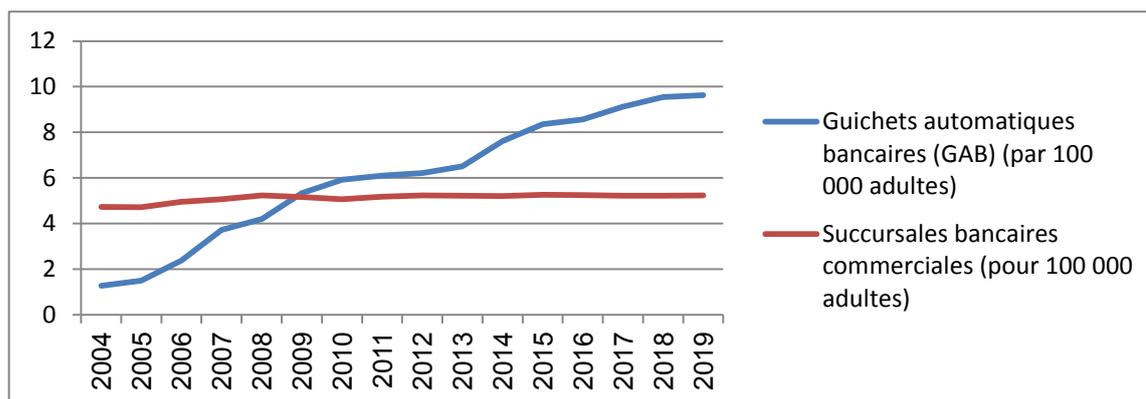
Source: Global Findex (2023)

The number of ATMs (per 100,000 adults) increased between 2004 and 2019, from 1.26 to 9.63 ATMs, respectively. This indicator has increased ninefold. This increase shows that there is a trend towards modernizing payment methods, as well as the willingness of different banks to access this service. However, the number of commercial bank branches (per 100,000 adults) has not experienced the same growth rate. It increased from 4.73 in 2004 to only 5.23 in 2019.

Fig.8. Change in the share of adults (+15) using mobile telephony or the internet to pay for public services
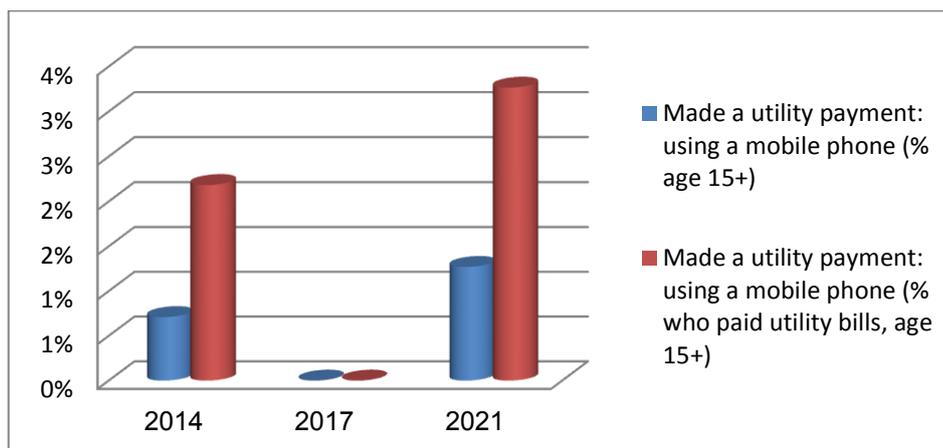
Source: Global Findex (2023)

In 2021, in terms of utility payments, only 1% of adults make a utility payment using a mobile phone. Only 2% make a utility payment using a mobile phone (% having paid utility bills, 15 years and older).

4. Estimation of the relationship between digital transformation and financial inclusion

The data used in this study come from the World Bank database. The variables were selected based on a literature review. These include, among others:

- The number of commercial bank borrowers per 1,000 adults (NEMPRU), which is considered a proxy for financial inclusion.

- The number of commercial bank branches per 100,000 adults as an indicator of financial inclusion.

- ATMs per 100,000 adults (denoted as ATMs).

- Mobile phone subscriptions (per 100 inhabitants) (denoted as TRANSNUM). This is considered a proxy for digital transformation .

The statistical characteristics and graphical evolution of our variables are described in Table 1 and Figure 8.

According to the table 1, the time series have a high level of consistency because their mean and median values are within their maximum and minimum values. The variables are normally distributed since the p-value corresponding to the Jacques Bera statistic is greater than 0.05, thus rejecting the null hypothesis for the different series.

Table 1. Summary Statistics of the Variables used for Analysis (2004-2023)

|	TRANSFONUM	NEMPRU	SUCURSABC	GAB
Mean	36870581	38.71561	5.193472	6.762335
Median	41372300	41.46776	5.258522	7.114214
Maximum	51522100	50.62408	5.348253	11.95785
Minimum	4882410.	23.27937	4.747415	1.272412
Std. Dev.	12618795	8.653842	0.175593	2.957325
Skewness	-1.087468	-0.570327	-1.691086	-0.403648
Kurtosis	3.363541	2.055628	4.722348	2.283293
Jarque-Bera	4.052089	1.827442	12.00464	0.971164
Probability	0.131856	0.401029	0.002473	0.615339
Sum	7.37E+08	774.3122	103.8694	135.2467
Sum Sq. Dev.	3.03E+15	1422.891	0.585827	166.1697
Observations	20	20	20	20

Source: Eviews 9 outputs

Fig.9. Graphical evolution of study variables
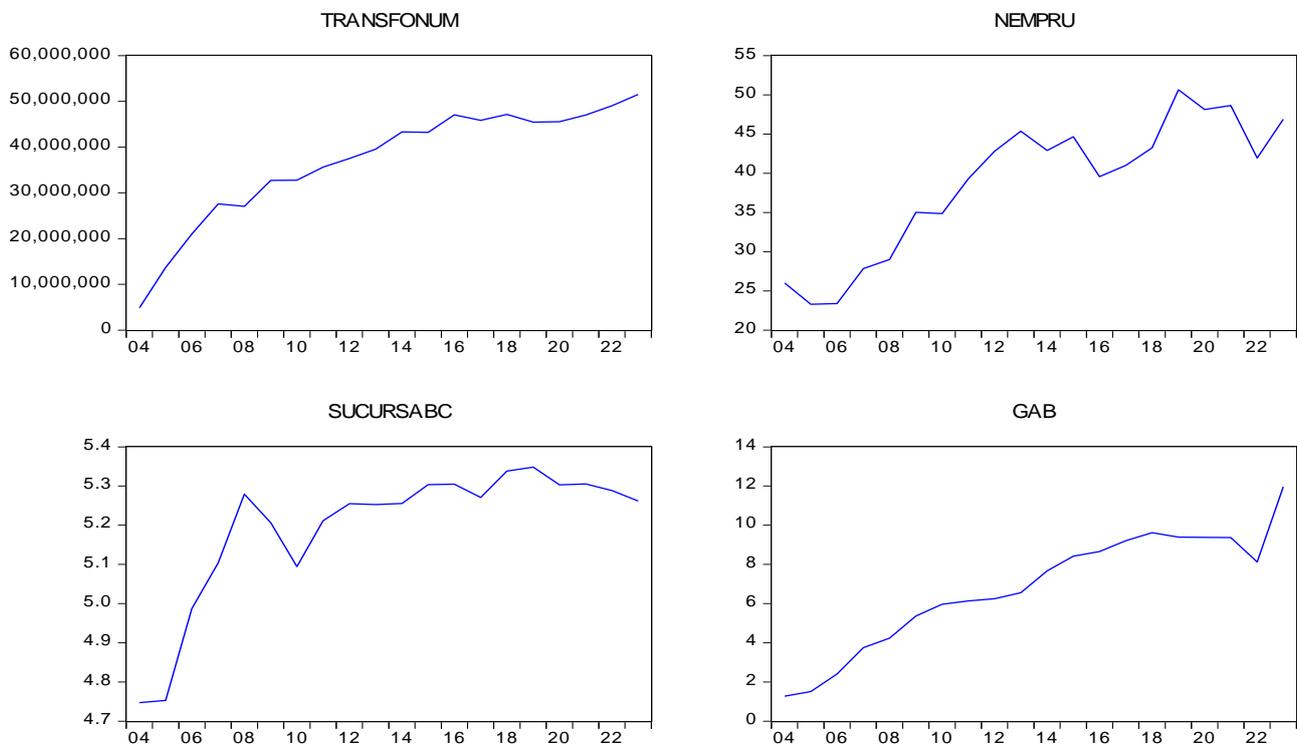
Source: Findex (2021) and World Bank(2023)

After describing the variables, we move on to, we move to the verification of the existence of a correlation between the number of borrowers from commercial banks per 1,000 adults and digital transformation, which is illustrated in the figure N°10.

Figure N° 10 : Scatter plot "Number of borrowers and digital transformation"
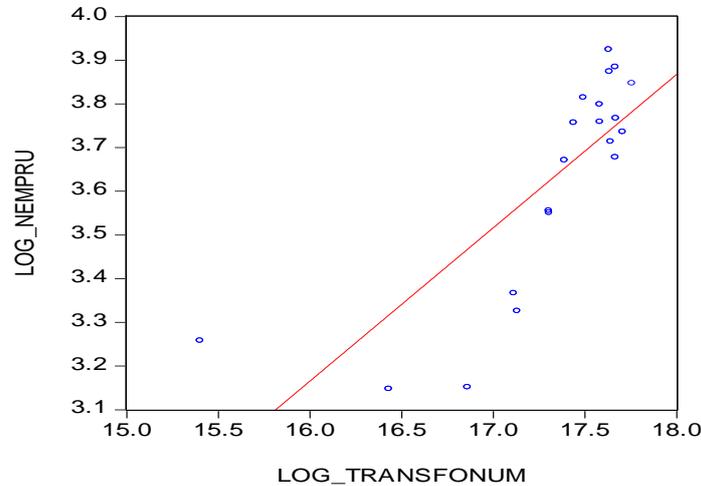
Source: Eviews 9 outputs

We note a strong association between these two variables.

The estimation of the impact of digital transformation on the number of borrowers from commercial banks per 1,000 adults in Algeria, obtained using Eviews 9 software, is shown in Table 2.

Table N°2. Simple regression estimation

Dependent Variable: LOG_NEMPRU
Method: Least Squares
Date: 10/08/25   Time: 18:57
Sample: 2004 2023
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_TRANSFONUM	0.350858	0.063674	5.510266	0.0000
C	-2.447908	1.103389	-2.218536	0.0396

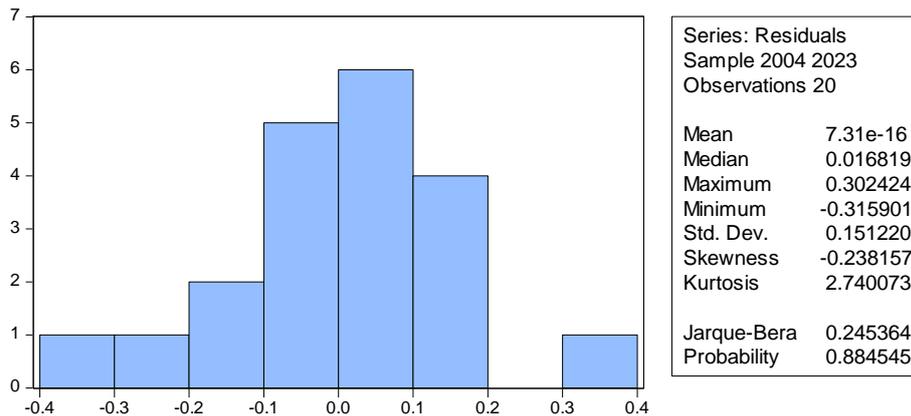|				
R-squared	0.627815	Mean dependent var		3.629044
Adjusted R-squared	0.607138	S.D. dependent var		0.247874
S.E. of regression	0.155364	Akaike info criterion		-0.791451
Sum squared resid	0.434484	Schwarz criterion		-0.691877
Log likelihood	9.914505	Hannan-Quinn criter.		-0.772013
F-statistic	30.36303	Durbin-Watson stat		0.884827
Prob(F-statistic)	0.000031			

Source: Eviews 9 outputs

From the results of the regression displayed in table N°2, the coefficient of determination (R^2) is estimated at 0.62, which is a value close to 1, indicating that 62% of the variability in the number of borrowers from commercial banks is explained by the variability in the number of mobile phone subscriptions. The student statistic of the

coefficient of the explanatory variable is greater than the tabulated value at the 5% level, which means that the coefficients associated with the number of mobile phone subscriptions is statistically significant. According to the simple regression estimation, the number of borrowers from commercial banks per 1,000 adults depends positively on the number of mobile phone subscriptions.

Model validation refers to various statistical tests (residual tests and coefficient tests). The results of these different tests are illustrated in the figures and tables below:

Figure N° 11. Normality Test of the Residuals

Series: Residuals	
Sample 2004 2023	
Observations 20	
Mean	7.31e-16
Median	0.016819
Maximum	0.302424
Minimum	-0.315901
Std. Dev.	0.151220
Skewness	-0.238157
Kurtosis	2.740073
Jarque-Bera	0.245364
Probability	0.884545

Source: Eviews 9 outputs

According to the results reported in the figure above, the probability associated with the Jarque-Bera statistic (which is 0.88) is greater than 5%. The hypothesis of normality of the residuals is retained.

Table N°3. Test of autocorrelation of the residuals using The Breusch–Godfrey Test

Result of the first-order auto-correlation test (1) on the residuals

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	4.341742	Prob. F(1,17)	0.0526
Obs*R-squared	4.068780	Prob. Chi-Square(1)	0.0437

Result of the second-order auto-correlation test (2) on the residuals

Breusch-Godfrey Serial Correlation LM Test:

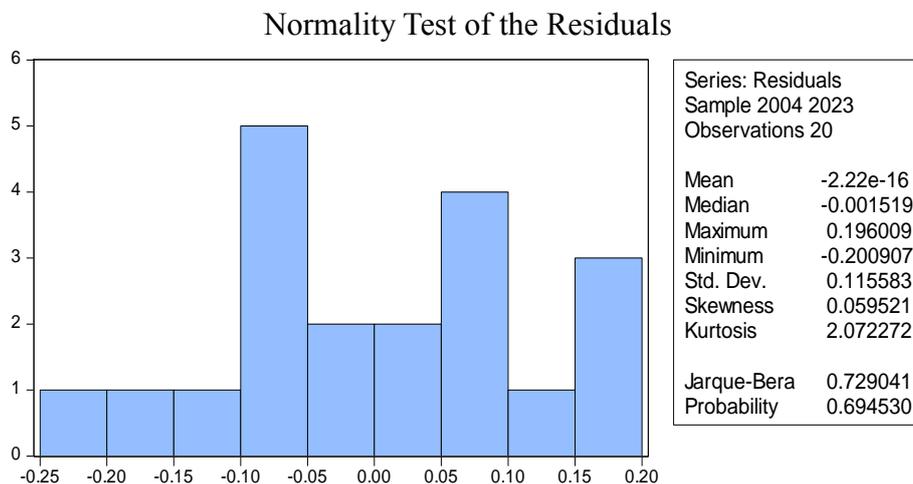|			
F-statistic	2.096785	Prob. F(2,16)	0.1553
Obs*R-squared	4.153371	Prob. Chi-Square(2)	0.1253

Source: Eviews 9 outputs

The results of the Breusch-Godfrey Serial Correlation LM test indicate that the probability of accepting H0 (0.15) is greater than 5%, so the hypothesis of autocorrelation of the residuals is validated.

Furthermore, the study of the impact of the number of Internet users (% of the population) (noted LOG_INTERNET) on the the number of borrowers from commercial banks gives us the results illustrated in table 4. The results show that the number of internet users (% of population) has a statically significant effect on the number of borrowers from commercial banks. These results are validated by the normality test.

Table N°4. Simple regression of the number of borrowers from commercial banks on the number of Internet users

```
Dependent Variable: LOG_NEMPRU
Method: Least Squares
Date: 10/08/25   Time: 19:04
Sample: 2004 2023
Included observations: 20
```

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_INTERNET	0.238218	0.029597	8.048826	0.0000
C	2.876530	0.097191	29.59661	0.0000

|			
R-squared	0.782566	Mean dependent var	3.629044
Adjusted R-squared	0.770486	S.D. dependent var	0.247874
S.E. of regression	0.118750	Akaike info criterion	-1.328945
Sum squared resid	0.253830	Schwarz criterion	-1.229371
Log likelihood	15.28945	Hannan-Quinn criter.	-1.309507
F-statistic	64.78360	Durbin-Watson stat	0.699936
Prob(F-statistic)	0.000000		

Figure N° 12. Normality Test of the Residuals

Normality Test of the Residuals

```
Series: Residuals
Sample 2004 2023
Observations 20

Mean        -2.22e-16
Median      -0.001519
Maximum      0.196009
Minimum     -0.200907
Std. Dev.    0.115583
Skewness     0.059521
Kurtosis     2.072272

Jarque-Bera  0.729041
Probability  0.694530
```

Source: Eviews 9 outputs

Drawing on the empirical work conducted by Rasheed, Law, Chin, & Habibullah (2016), we will assess the link between digital transformation and the financial inclusion indicator "number of commercial bank branches per 100,000 adults" noted in this study (SUCURSABC). The results are reported in Table 4.

Figure N° 13: Scatter plot "Number of branches and digital transformation"
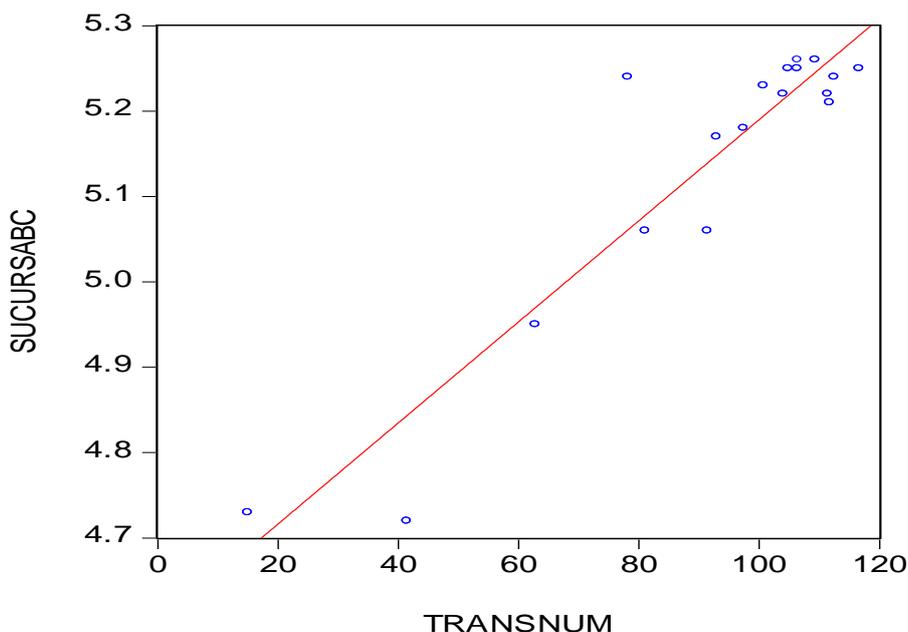
Source: Eviews 9 outputs

According to the fig N°, A strong correlation between the number of branches and digital transformation are showen in the Scatter plot

Table N°5. Estimation of the link between digital transformation and the number of branches

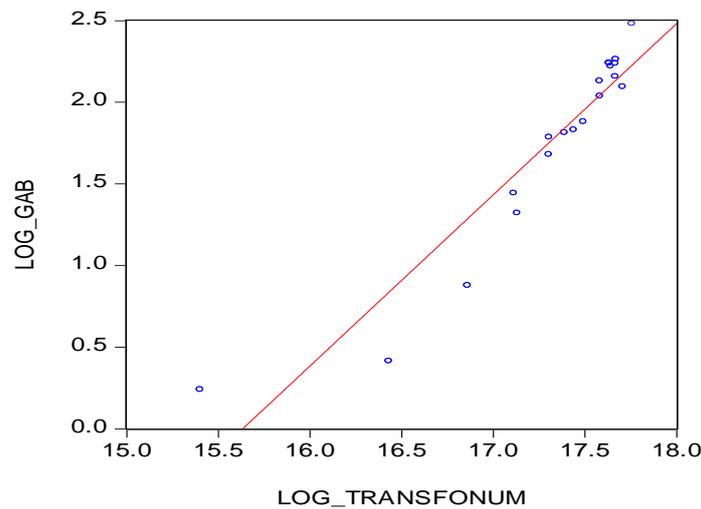| Dependent Variable: LOG_SUCURSABC				
Method: Least Squares				
Date: 10/08/25 Time: 19:16				
Sample: 2004 2023				
Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_TRANSFONUM	0.057050	0.005841	9.766542	0.0000
C	0.658717	0.101224	6.507501	0.0000
R-squared	0.841249	Mean dependent var		1.646838
Adjusted R-squared	0.832430	S.D. dependent var		0.034818
S.E. of regression	0.014253	Akaike info criterion		-5.569057
Sum squared resid	0.003657	Schwarz criterion		-5.469484
Log likelihood	57.69057	Hannan-Quinn criter.		-5.549619
F-statistic	95.38535	Durbin-Watson stat		1.929006
Prob(F-statistic)	0.000000			

Source: Eviews 9 outputs

The results of estimating the link between digital transformation and financial inclusion, measured by the number of commercial bank branches per 100,000 adults, as reported in Table 5, confirm the results found previously. Indeed, the p-value associated with the Transnum variable, which is less than 5%, shows that digital transformation positively and significantly affects financial inclusion in Algeria. The coefficient of determination (R^2), which is equal to 0.84, indicates that 84% of the variability in the

number of commercial bank branches is explained by the variability in the number of mobile phone subscriptions.

Following the study of Rasheed, Law, Chin, & Habibullah (2016), ATMs per 100,000 adults will also be used as a measure of financial inclusion in Algeria, noted GAB. The level of correlation between these two variables and the estimation results are reported in Figure 12 and Table 6.

Figure N° 14 : Scatter plot " GAB and digital transformation"
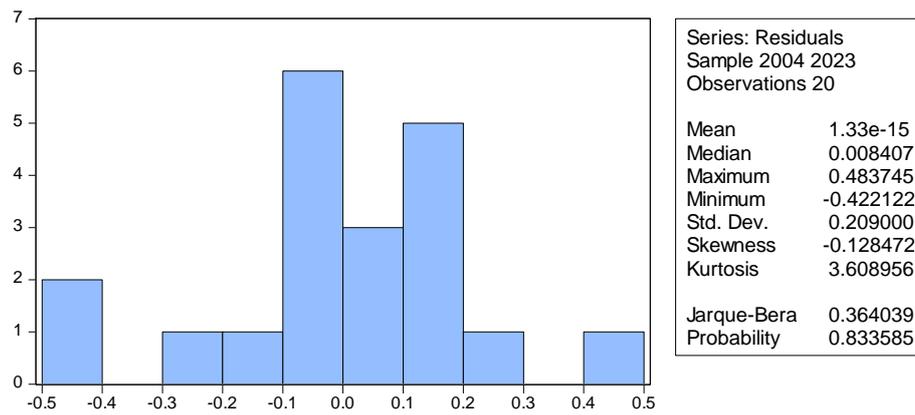

Source: Eviews 9 outputs

Table N°6. Estimation results of the link between digital transformation and the number of ATMs

Dependent Variable: LOG_GAB				
Method: Least Squares				
Date: 10/08/25 Time: 19:07				
Sample: 2004 2023				
Included observations: 20				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_TRANSFONUM	1.048651	0.088002	11.91617	0.0000
C	-16.39326	1.524979	-10.74982	0.0000
R-squared	0.887497	Mean dependent var		1.769639
Adjusted R-squared	0.881246	S.D. dependent var		0.623107
S.E. of regression	0.214727	Akaike info criterion		-0.144261
Sum squared resid	0.829936	Schwarz criterion		-0.044688
Log likelihood	3.442614	Hannan-Quinn criter.		-0.124824
F-statistic	141.9950	Durbin-Watson stat		1.271460
Prob(F-statistic)	0.000000			

Source: Eviews 9 outputs

The estimation results, as reported in Table 6, indicate that 88% of the variability in the number of ATMs per 100,000 adults is explained by the variability in the number of mobile phone subscriptions. In terms of individual significance, the p-value associated with the Transnum variable is less than 5%, thus showing that digital transformation positively and significantly affects financial inclusion in Algeria.

Figure N° 15. Normality Test of the Residuals

Source: Eviews 9 outputs

5. CONCLUSION

The objective of this study was to examine the relationship between digital transformation and financial inclusion in Algeria through econometric modeling based on three simple regression models using annual data covering the period (2004-2021). Analysis of financial inclusion indicators, taken from the Global Findex 2011 database, shows that Algeria is lagging behind other countries. Regarding digital transformation, the banking sector, through SATIM, has embraced the process.

The results of the econometric study show that the number of mobile phone subscriptions positively affects financial inclusion, as measured by the three indicators. These results suggest a profound digital transformation by generalizing digitalization to all financial services (including microfinance) with a view to achieving sustainable development goals.

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