

Evaluating the Influence of Cash Leakage on Money Multiplier and Banking Credit Expansion in Algeria 1990-2022

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Abstract:

This study aimed to evaluate the impact of cash leakage on the ability of banks to expand lending, utilizing the money multiplier and cash leakage values. The study incorporated the cash leakage to M2 ratio and the volume of loans granted to the economy. Drawing on data and reports from the Bank of Algeria, a simple regression model was developed for the study variables.

The findings revealed a strong negative impact of cash leakage on the money multiplier, subsequently affecting banks' capacity to expand credit. This underscores the necessity for policymakers in monetary policy to reduce cash leakage through the adoption of financial technology and financial inclusion initiatives.

Keywords: Cash Leakage, Money Multiplier, money creation, loans

Jel Classification Codes : E51 ; E58

Résumé:

Cette étude vise à évaluer l'impact du déversement de liquidités sur la capacité des banques à étendre leurs prêts, en utilisant le multiplicateur monétaire et les valeurs de déversement de liquidités. Le modèle de régression simple intègre le ratio de déversement de liquidités par rapport à M2 et le volume des prêts accordés à l'économie. Les résultats mettent en évidence un impact négatif significatif du déversement de liquidités sur le multiplicateur monétaire, affectant la capacité des banques à étendre le crédit. Cela souligne la nécessité pour les décideurs en politique monétaire de réduire le déversement de liquidités par le biais de l'adoption de la technologie financière et d'initiatives d'inclusion financière.

Mots clés: Déversement de liquidités, Multiplicateur monétaire, création monétaire, prêts.

Jel Classification Codes : E51 ; E58

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I. Introduction

The complex mechanisms involved in the process of money creation inside commercial banks are a crucial element of contemporary economic systems. These mechanisms have a significant impact on the financial environment and play a role in determining economic stability. This study explores the intricate domain of money creation inside commercial banks, specifically examining the consequences of cash leakage in the Algerian banking industry. To comprehend the generation, circulation, and management of money in the Algerian banking system, one must grasp the complex relationship between monetary policies, regulatory frameworks, and the operational complexities of banks.

The Algerian banking industry is an essential element of the country's economic infrastructure, serving a crucial function in enabling financial transactions, promoting economic development, and ensuring monetary stability. This research aims to provide insight into the distinctive difficulties and prospects associated with the banking sector in Algeria, specifically focusing on the possible outflows of cash and their effects on the whole monetary system.

Given the fast changes in the global financial environment and the growing issues faced by countries, the study of money generation becomes more important. The precise scrutiny of cash leakage inside commercial banks provides a detailed analysis of a phenomena that may significantly impact the stability and effectiveness of the Algerian banking industry.

This study seeks to comprehensively examine the process of money creation, specifically focusing on money creation and control. Additionally, it tries to investigate the potential ramifications of cash leakage on money multiplier. Our goal is to provide valuable insights that can inform policymakers, regulators, and banking practitioners in Algeria. This will help them gain a deeper understanding of the dynamics at play in the banking sector and make informed decisions to enhance its resilience and sustainability.

In the next parts of this article, we will explore the theoretical underpinnings of money creation, examine and use empirical analysis to evaluate the influence of cash leakage on money multiplier and banking credit expansion. Our objective is to present a complete analysis of money creation in commercial banks, with the goal of providing practical suggestions to strengthen the banking system in Algeria and ensure its resilience.

The impact of cash leakage on the money multiplier is a complex issue, influenced by various factors (Zhang et al., 2012). found that the use of electronic money can increase the money multiplier by reducing cash leakage, but this effect is overshadowed by the impact of deposit reserve rates (Mughal et al., 2021). highlighted the bias in the money multiplier due to the informal sector, where cash transactions are prevalent and can lead to a larger multiplier effect

(Xiong et al., 2018). emphasized the role of prudential regulations, such as liquidity and default risk portfolios, in determining the maximum money supply (Beenstock, 1989). identified institutional changes, interest rates, and economic activity as key determinants of the money multiplier. These studies collectively suggest that while cash leakage can impact the money multiplier, it is just one of many factors at play.

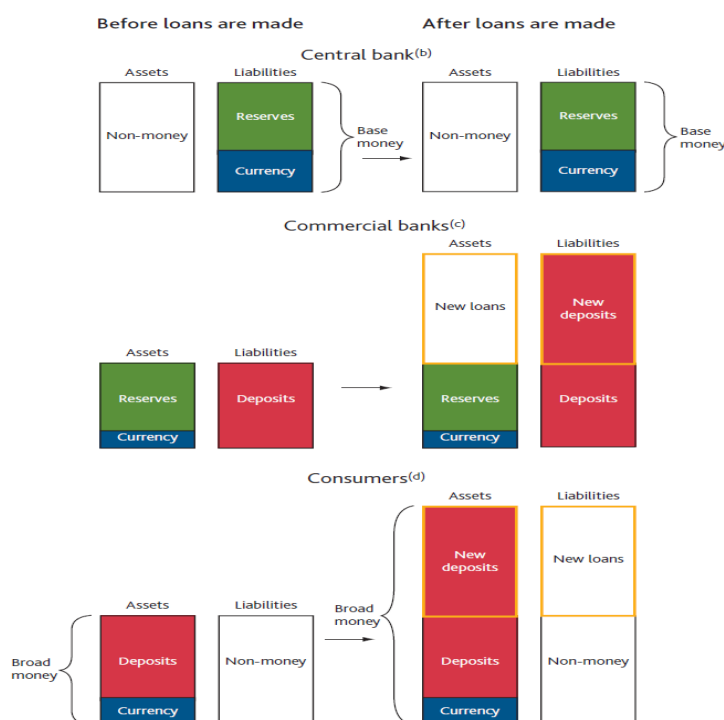
These studies have predominantly focused on the banking environment in advanced economies. here, we seek to comprehend the complexities of these relationships in Algeria, within a banking environment grappling with challenging regulatory and structural issues, in addition to liquidity pressures stemming from consecutive oil crises.

II. Money creation

some economists have referred to bank deposits as ‘fountain pen money’, created at the stroke of bankers’ pens when they approve loans(Tobin, 1963).

Money is a measure of the total amount of money held by households and companies in the economy. Broad money is made up of bank deposits which are essentially IOUs from commercial banks to households and companies and currency mostly IOUs from the central bank. Of the two types of broad money, bank deposits make up the vast majority 97% of the amount currently in circulation. And in the modern economy, those bank deposits are mostly created by commercial banks themselves(Mcleay et al., 2014).

Fig 1 Money creation by the aggregate banking sector making additional loans



Source: (Mcleay et al., 2014)

II.1. how is money created?

how is money created? While many people believe banks first raise money and then lend it to others, this is not how it works in the current system. When a borrower obtains a loan from a bank, the bank simultaneously grants the loan and creates a bank deposit (the money). Banks thus create new money when granting loans (Stellinga et al., 2021). The money creation procedure in commercial banks typically entails the following:

a. Deposit Creation

When someone deposits money in a bank, the bank doesn't have to hold on to the whole amount. It only needs to keep a small portion of the amount as savings, and the rest can be used for lending money and making investments. In fractional reserve banking, banks are only required to hold on to a small portion of their savings in reserve. This process is at the heart of the system. (Mishkin & Serletis, 2011).

b. Fractional Reserve System

In a fractional reserve system, banks are allowed to lend out a significant portion of the funds deposited by customers. For example, if the reserve requirement is 10%, the bank must keep 10% of each deposit in reserve, and the remaining 90% can be used for lending and other investments.

c. Loan Origination

By giving out loans, banks make money. When a bank accepts a loan, it adds new money to the borrower's account. This is money that wasn't in the economy before the loan was given. For banks to be able to make money, this process is essential. (Keister James McAndrews et al., 2009).

d. Money Creation through Lending

The crux of comprehending deposit creation resides in the observation that banks do not tangibly transfer existing deposits from one account to another when extending loans. Conversely, a fresh deposit is generated in the borrower's account, thereby augmenting the overall money supply in circulation. As an element of the larger money supply, this newly created deposit stimulates economic activity (Mishkin & Serletis, 2011).

e. The multiplier effect

The multiplier effect arises as a result of the fractional reserve system. When borrowers spend the newly produced money or deposit it in another bank, that bank may use a portion of the new deposit to give out more loans, resulting

in a multiplier impact on the money supply (Ritter, 2003).

we can derive all of the above results using a concept called the money multiplier, denoted by **k**, which tells us how much the money supply changes for a given change in the monetary base (Keister James McAndrews et al., 2009). The relationship among the money supply, the money multiplier, and the monetary base is described by the following equation when reserves denoted by **R**:

$K = 1/R \dots \dots \dots (1)$. This equation makes the assumption that there is no currency leakage.

When there is a monetary leakage denoted by **f**, the multiplier may be determined using the following equation:

$$K = \frac{1}{R + f - R * f} \dots \dots \dots (2).$$

II.2. Example Scenario

Assuming there is only one bank in the national economy, and the central bank has set a reserve requirement rate of 10%, with no cash leakage. Assume a single consumer makes a deposit of \$1,000 into this bank.

We will denote the reserve requirement as **R**, the deposit as **D**, the money supply as **M**, and the money created as **Ms**.

The bank's balance sheet will be as follows:

Assets		Liabilities	
Reserves	100\$	Deposits	1000 \$
Securities	900\$		

Once the bank loans the whole amount it now has (\$900), assuming that clients only use checks for transactions and there is no cash leakage, the consumer will then deposit the amount back into the same bank. As a result, the bank approves the loan and records it as a new deposit at the same time.

Assets		Liabilities	
Reserves	100\$	Demand Deposits	1000 \$
loans	900\$	Credit Deposits	900\$

In this case, the bank utilizes the new deposit as well by deducting a reserve percentage and lending the remainder.

Assets		Liabilities	

Reserves	190\$	Demand Deposits	1000 \$
loans	900\$	Credit Deposits	900\$
Credit Money	810\$		

The bank continues on this course until the sum of reserves equals the value of the initial deposit. Here, we find that the quantity of money at the bank is formed by two types of deposits: demand deposits and credit deposits.

$M = D + M_s \dots\dots\dots(3).$
 $M = D * K \dots\dots\dots(4)$

Applying Equation 1, we find that the number of times the bank can expand money creation is:

$K = 1/R = 1/0,1 = 10$
 Applying Equation 4, we find money supply as:
 $M = D * K = 1000 * 10 = 10\ 000\$$

Applying Equation 3, we find credit deposits as:
 $M = D + M_s \Rightarrow M_s = M - D$
 $M_s = 10\ 000 - 1000 = 9000$

In the end, we found that the bank, using a deposit of \$1,000, can expand money creation until it possesses a money supply ten times that amount.

It can also be inferred that the bank's ability to create money is inversely related to the reserve requirement ratio, and this falls within the monetary policy pursued by central banks to expand or tighten monetary policy.

II.3. Cash Leakage effect

Cash leakage is the occurrence in the economic and financial environment when physical cash is used outside of conventional banking and financial institutions. In order to navigate the complexities of monetary policy and financial stability, policymakers, central banks, and financial institutions must have a thorough understanding of the repercussions of currency leakage (Review & Gardner, 1984).

A crucial element of money creation, the multiplier effect is disrupted by cash leakage. Multipliers of banks' reserves must be lent in order for the multiplier effect to occur. A reduction in reserves available for lending occurs as a consequence of cash leakage, thereby diminishing the potential impact of the multiplier effect (Galbraith, 1968).

Through the previous example, and by replacing the third assumption with the presence of a 20% cash leakage, we can represent the scenario as follows:

Assets	Liabilities

Reserves	100\$	Demand Deposits	1000 \$
loans	900\$	Credit Deposits	720\$

$$F = 180\$$$

Using Equation 2, we find

$$K = \frac{1}{R+f-R*f} = 5,26$$

Here, a clear decrease in the number of times the bank can expand money creation is evident, reducing from 10 times to just over five times. This is due to the impact of withdrawing 20% of the cash from the bank. The volume of derived deposits can be calculated here using Equations 3 and 4 as follows:

$$M = K * D = 5,26 * 1000 = 5263,15 \$$$

$$Ms = 5263,15 - 1000 = 4263,15$$

Based on the information provided, we may infer that there is an inverse correlation between the bank's capacity to increase the production of money and the percentage of cash leakage in the economy. Hence, any loss of cash immediately affects the increase of the money supply and, as a result, the functioning of lending and investment activities. This suggests a direct impact on the rates of growth.

III. Description of sample data and selection of model variables

We use annual data from 1990 to 2022 to research. Loans are calculated based on the total loans provided to various sectors: The public sector, the private sector including loans directed to the household sector, as well as the public administration sector. The cash leakage represents the ratio of cash transactions outside of banks to the broad money supply (M2). The Money Multiplier reflects the rate of credit deposits that are created as a result of receiving deposits and providing loans. It outlines the calculating process in accordance with Equation 2, as was previously explained.

These statistics were taken from a variety of sources, including the annual reports of the Bank of Algeria, reports from the Directorate of Policies and Forecasts at the Ministry of Finance, and publications from the National Office of Statistics.

Table 1: Cash leakage and related influencing data

Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cl ratio	39,3	37,9	35,8	33,7	30,8	31,2	31,8	31,2	24,5	24,6	24	23,3	22,9	23,3	23,4	22,2
Mm	4,3	4,2	4,2	4,1	4,0	3,9	3,8	3,8	3,7	3,6	3,7	3,2	3,4	2,9	3,1	3,5
Loans	247	325,8	412,3	220,2	305,8	565,6	776,8	741,3	906,1	1150,7	993,7	1078,4	1266,8	1380,1	1535	1779,7
Fc	134,9	157,2	184,8	211,3	222,9	249,7	290,8	337,6	390,4	439,9	484,5	577,2	664,7	781,3	874,3	921

years	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cl ratio	22	21,4	22,1	25,5	25,3	25,9	26,8	26,8	26,9	30	32,5	31,5	29,6	32,9	34,8	33,6	33,2
Mm	3,6	3,5	3,6	3,2	3,1	3,2	3	2,9	2,9	2,6	2,6	2,4	2,7	2,5	2,6	2,5	2,5
Loans	1905,4	2205,2	2615,5	3086,5	3268,1	3726,5	4287,6	5156,2	6504,5	7277,2	7909,8	8880	9976,3	10857,8	11182,2	10407,9	10115,2
Fc	1081,4	1284,5	1540	1829,4	2098,6	2571,5	2952,3	3204	3685,9	4108,1	4497,2	4716,9	4926,8	5437,6	6138,3	6746,6	7392,8

Source: bank of algeria database

1.Cash Leakage (Fc): It refers to the actual value of cash leakage, representing the amount of money circulating outside the banking system, in other words, the money in its simple form, the primary component of the M1 monetary aggregate. Here, we use it to express the quantity of cash leakage as an independent variable.

At the beginning of the study period in 1990, the cash leakage value (Fc) was 134.9, signifying that a portion of the money was circulating outside the banking system. Over time, this value increased, reaching its peak in 2010 at 2098.6.

Subsequently, the cash leakage value began to gradually decline, dropping to 6746.6 in 2021. This fluctuation can be interpreted by the influence of various economic and monetary factors, including changes in consumption patterns and financial.

2. The Money Multiplier (Mm): As a dependent variable, the Monetary Multiplier (Mm) demonstrates the evolution of the money multiplier over the study period, indicating the relationship between the creation of credit, the volume of loans to the economy, and the cash leakage.

In 1990, the monetary multiplier (Mm) was 4.3, suggesting that for every unit increase in the money supply, there was an associated 4.3-fold increase in credit creation.

The multiplier remained relatively stable in the following years, with slight variations. It decreased to 3.8 in 1996, then increased again, reaching 3.2 in 2001.

Notably, the monetary multiplier experienced a significant drop in 2003, decreasing to 2.9. This could be indicative of changes in monetary policy or other economic factors influencing credit creation.

Over the subsequent years, the multiplier showed fluctuations, with a gradual increase to 3.6 in 2009, followed by a decline to 2.5 in 2019.

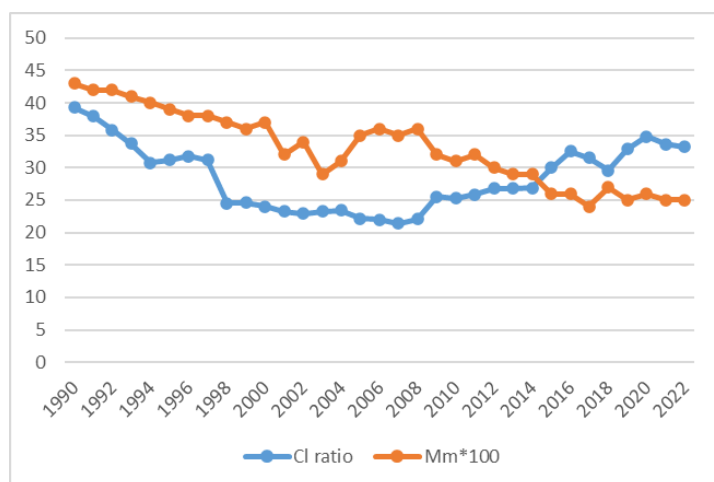
Table 2: Descriptive Statistics

	Mean	Std. Deviation	N
Fc	2155,5879	2192,57717	33
Mm	3,2970	,57363	33

Source: Adopted from the SPSS 27 outputs

In 2022, the multiplier is recorded at 2.5, indicating that there is a 2.5-fold increase in credit creation for every unit increase in the money supply. The monetary multiplier appears to reflect the resilience of the banking sector to the impact of the COVID-19 pandemic during the period from 2019 to 2022.

Fig.2: the money multiplier and cash leakage



Source: Adopted from the Table 1

The figure indicates opposing trends for the curves of the money multiplier and cash leakage for significant periods throughout the study period, suggesting an inverse relationship between them.

Based on the above, we chose to apply a regression model to measure the extent of the impact of cash leakage on the money multiplier and the expansion of banks in lending, after ensuring the suitability of its application.

IV. The regression model and discussion

The regression model provides insights into the relationship between cash leakage, the money multiplier, and the expansion of banks in lending.

IV.1. Correlations

Table 3: Correlation

		Fc	Mm
Pearson Correlation	Fc	1,000	-,870
	Mm	-,870	1,000
Sig. (1-tailed)	Fc	.	,000
	Mm	,000	.
N	Fc	33	33
	Mm	33	33

Source: Adopted from the SPSS 27 outputs

The Pearson correlation coefficient between Fc and Mm is -0.870, indicating a strong negative correlation between cash leakage and the money multiplier. The correlation is statistically significant ($p < 0.05$).

IV.2. Model Summary

Table 4: R square

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,870	,757	,749	1099,18511	,402

Source: Adopted from the SPSS 27 outputs

The model has an R-squared value of 0.757, suggesting that approximately 75.7% of the variability in money multiplier (Mm) can be explained by the cash leakage (Fc).

IV.3.ANOVA

Table 5: ANOVA (F-test)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	116382183,959	1	116382183,959	96,326	,000
	Residual	37454444,877	31	1208207,899		
	Total	153836628,835	32			

Source: Adopted from the SPSS 27 outputs

The ANOVA table indicates that the regression model is statistically significant ($p < 0.05$), meaning that at least one predictor variable (Mm) significantly predicts the dependent variable (Fc).

IV.4.Coefficients

Table 6: Coefficient (T-test)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	13116,590	1133,079		11,576	,000
	Mm	-3324,569	338,737	-,870	-9,815	,000

Source: Adopted from the SPSS 27 outputs

The coefficient for the variable Mm is -3324.569 with a standard error of 338.737. This negative coefficient suggests that as the cash leakage (Fc) increases, money multiplier tends to decrease. The coefficient is statistically significant ($p < 0.05$).

IV.5.Residuals Statistics

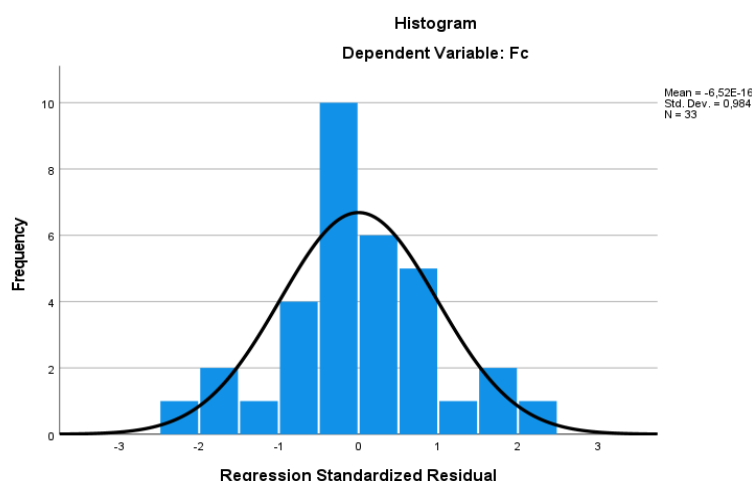
Table 7: normality test

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-1179,0553	5137,6255	2155,5879	1907,07715	33
Residual	-2694,04102	2587,63159	,00000	1081,87402	33
Std. Predicted Value	-1,749	1,564	,000	1,000	33
Std. Residual	-2,451	2,354	,000	,984	33

Source: Adopted from the SPSS 27 outputs

The residuals (differences between observed and predicted values) show a mean close to zero, indicating that the model is well-fitted.

Fig 3: Normality test



Source: Adopted from the SPSS 27 outputs

V. conclusion

The results of this study provide valuable insights into the correlation between cash leakage and the money multiplier, shedding light on how these variables impact bank lending expansion. Let's delve into a detailed discussion and offer recommendations for researchers and decision-makers:

- **Strong Negative Correlation**

The presence of a robust negative correlation (-0.870) between cash leakage and the money multiplier suggests that an increase in cash leakage is associated with a significant decrease in the money multiplier. This implies that cash leakage negatively affects banks' ability to amplify cash in the economy.

- **Strong Model Explanation**

The R-squared value of 0.757 indicates that approximately 75.7% of the variability in the money multiplier can be explained by cash leakage. This demonstrates the model's strength in predicting changes in the money multiplier and underscores the importance of the impact of cash leakage on this variation.

- **Statistical Significance of the Model**

ANOVA results show the statistical significance of the model overall ($p < 0.05$). This implies that cash leakage (specifically, the money multiplier) significantly contributes to explaining the variance in the outcomes. This emphasizes the importance of understanding the effects of cash leakage in the banking context.

- **Economic Impact of Cash Leakage**

The negative coefficient for the money multiplier (-3324.569) signifies the economic impact of cash leakage. An increase in cash leakage results in a substantial decrease in the money multiplier. This suggests that banks face challenges in expanding lending activities in the context of cash leakage.

VI. Recommendations

We propose the following to decision-makers in monetary and financial policies:

- **Enhance Cash Leakage Oversight**

financial authorities should strengthen oversight of cash leakage to mitigate its impact on the money multiplier. This may involve reviewing bank policies and improving financial monitoring and reporting.

The general use of payment cards should be promoted and encouraged through the provision and facilitation of automated payment mechanism.

Experiments show that the adoption of high-denomination banknotes easily increases cash leakage, in addition to contributing to money laundering and tax evasion, therefore, there is a need to reconsider the withdrawal of large-denomination currency to encourage individuals and institutions to shift towards banking transactions and electronic payments.

- **Policy Guidance for Monetary Authorities**

Monetary policies should be directed towards supporting banks in addressing the challenges posed by cash leakage to ensure the continuity of their lending expansion.

- **Further Studies**

Additional studies are recommended to better understand the mechanisms associated with the impact of cash leakage on the money multiplier. This would provide additional insights for policymakers and economists.

- **Interaction with the Overall Economic Context**

Banks and regulatory authorities should consider the interaction between cash leakage and broader economic conditions, adjusting their policies accordingly.

In conclusion, the results of this study underscore the importance of managing cash leakage as a factor influencing bank lending expansion. This is a topic that warrants further research and analysis to deepen our understanding of its effects.

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