MONETARY DETERMINANTS OF THE ALGERIAN DINAR EXCHANGE RATE

Lachachi Mostefa*[1], Benkaddour Ali[2]

[1,2] University of Saïda Dr Moulay Tahar, Saïda, Algeria

Email: mostefa.lachachi@univ-saida.dz[1] , benkaddourali.eco@gmail.com [2]

Abstract

This study aims to analyze the monetary determinants of the Algerian Dinar exchange rate over the period 1970-2022 using a basic financial model. The estimation results indicate that 77% of the variation in the nominal exchange rate can be explained by the studied variablesM,M^*,RY, 〚RY〛^*and this finding remains robust even when accounting for changes in the real exchange rate. The results suggest that fluctuations in the nominal exchange rate of the Algerian Dinar are significantly influenced by monetary and real shocks, particularly those associated with strong growth in the money supply. Consequently, the Algerian Dinar will likely depreciate over time, regardless of the economic growth rate. Furthermore, estimates of the real exchange rate indicate a weak influence of monetary factors on its evolution, likely due to price rigidities.

Keywords: Exchange rate, Stationarity, Cointegration, ECM.

JEL Classification: F13 ،F41،C13

1. Introduction:

This study examines the monetary determinants of the Algerian Dinar exchange rate. The misalignment of the exchange rate, combined with an unsustainable development strategy that relied on substantial capital inflows and contributed to an excessive expansion of the money supply, generated significant inflationary pressures, particularly during the 1980s. The absence of timely corrective measures resulted in the depreciation of the Dinar, coinciding with a depletion of foreign currency reserves.

This situation necessitated the devaluation of the Dinar to mitigate the economic crisis primarily driven by the decline in oil prices, as Algeria transitioned toward a market-based economy. Research by Derv are (1987) and Edwards (1999) indicates that misalignment between real and nominal exchange rates can negatively impact the economic performance of emerging economies. An overvalued exchange rate may lead to macroeconomic imbalances, including high inflation, rising unemployment, and reduced competitiveness, ultimately weakening the external position and depleting foreign exchange reserves.

Accordingly, this study aims to examine the strength of the relationship between monetary variables and the behavior of the Algerian Dinar. In doing so, we seek to evaluate the role of monetary policy in exchange rate determination and apply a fundamental monetary model to the Algerian economy. Thus, the research question can be formulated as follows:

1.1. Research Question:

Under the assumption of price liberalization and currency devaluation, does convergence occur between domestic and foreign inflation rates? Additionally, is there a relationship between the evolution of inflation differentials and the determination of the Algerian Dinar exchange rate?

To explore this research question, the following hypotheses are proposed:

1.2. Hypotheses:

- To assess the relative competitiveness of the domestic economy compared to foreign economies in terms of supply and demand for goods, as well as local and foreign capital, the determination of the real equilibrium exchange rate using price differentials is a crucial measure. This approach considers both the advantages offered by the real exchange rate and the challenges and criticisms associated with its use.

- The determination of the equilibrium exchange rate involves multiple dimensions that monetary authorities must consider to establish an appropriate exchange rate aligned with their economic objectives. One key dimension is the price differential, which plays a crucial role in determining the real equilibrium exchange rate. This approach accounts for inflation differentials between the domestic and foreign economies when setting the exchange rate.

1.3. Limits of the Study:

This study defines within both temporal and spatial frameworks. Spatially, it focuses on the case of the Algerian economy. Temporally, it examines, analyzes, and evaluates the impact of monetary variables on the behavior of the Algerian Dinar over the period from 1970 to 2022.

1.4.The importance of research:

The significance of this research lies in the critical role of price differentials as a key determinant of the real equilibrium exchange rate. This is achieved by examining and evaluating the strength of the relationship between monetary variables and the behavior of the Algerian Dinar.

Study Axes:To address the research problem, the study is divided into two main axes:

1. Determining the real equilibrium exchange rate based on price differentials.

2. Establishing the exchange rate within the framework of a monetary approach.

2. Inflation Differentials:[1]

Monetary stability plays a crucial role in protecting the economy from the adverse effects of external shocks, preventing the deterioration of living standards, and serving as a fundamental condition for fostering growth in savings and investment levels. The stability of the exchange rate is a key pillar of monetary stability; When the exchange rate is realistic, it supports the economic objectives set by the state. Additionally, it contributes to improving the current account balance and

strengthening foreign currency reserves, which are essential for managing the exchange rate. Furthermore, it plays a vital role in shielding the national economy from inflationary pressures.

The significance of the exchange rate in diversifying the production structure stems from its impact on the local prices of internationally traded goods. Changes in the exchange rate influence the relative prices of traded goods compared to domestically produced goods. Due to price differences across countries and varying inflation rates, increasing attention is being given to the role of exchange rates in facilitating international transactions.

Determining the equilibrium exchange rate involves multiple dimensions that monetary authorities must consider establishing an appropriate rate that aligns with their economic objectives. One key dimension is the price differential, which plays a crucial role in determining the real equilibrium exchange rate. This approach accounts for inflation differences between the domestic and foreign economies when setting the exchange rate.

This measure is particularly significant as it serves as a benchmark for evaluating the relative competitiveness of the domestic economy in comparison to foreign economies, considering supply and demand for goods as well as both local and foreign capitals. Consequently, this dimension encompasses both the benefits offered by the real exchange rate and the potential challenges or criticisms associated with its application.

Many questions arise:

Does domestic inflation converge with foreign inflation under the pressures of price liberalization and national currency devaluation? To what extent does this convergence depend on the level of economic development? Furthermore, is there a relationship between the evolution of inflation differentials and the determination of the Algerian Dinar exchange rate?

The general relationship that links the growth rate of nominal and real exchange rates with inflation differentials can be expressed as follows:

$$[1]\, d\log(TCN) = d\log(TCR) + INFD - INFusa \quad [2]$$

Whereas :

$INFD$: domestic inflation rate‹$INFus$:external inflation rate.

$d\log(TCN)$: growth rate of the nominal exchange rate‹$d\log(TCR)$ growth rate of the real exchange rate

Table (1) : Estimating inflation differences on nominal exchange rate (1970-2022).

R^2	DW	C	d log(Y)	d log(M)	$INFusa$	$INFD$	
0.24	1.08	-	-	-	-1.6689	1.3947	d log(TCN)
		-	-	-	-1.3244	3.6266	t-Statistic
0.01	0.4	12.03	-0.1744	0.0668	-	-	d log(TCR)
-	-	3.75	-0.6617	0.5359	-	-	t-Statistic

Source : IFS(2023) estimation method ols Eviews11.

The correlation between Algeria's inflation rate (INFD) and the foreign inflation rate (INFusa) is, in terms of significance, close to the values predicted by economic theory (+1 and -1).

However, the overall correlation coefficient (R^2) remains weak. This suggests that inflation differentials in Algeria have not played a significant role in shaping exchange rate policy. Moreover, when analyzed through the money demand equation within Algeria's monetary policy framework, domestic inflation appears to be largely independent.

3. Exchangerate and monetary position:

Monetary theoretical models for analyzing exchange rate behavior lead to a fundamental conclusion: the monetary approach to exchange rate determination has expanded to include a wide range of quantitative models. The roots of this approach can be traced back to the basic monetary model (flexible price–sticky price), in which the exchange rate, under flexible pricing conditions, is determined by a set of fundamental variables. Some of these variables are monetary, including money supply, expected exchange rate, expected inflation rate, and anticipated changes in money supply, while others are real, such as the level of national income.[3]

The sticky price model does not differ from the basic flexible price model regarding the variables that determine the exchange rate in the long run. However, in the short run, exchange rate determination requires the inclusion of adjustment coefficients that account for the discrepancy between the long-term equilibrium exchange rate and the short-term equilibrium level.[4]

As a result, price flexibility has become the exception rather than the norm in the monetary model of exchange rate determination underprice stickiness.

Girton and Roper extended the monetary model of exchange rate determination by developing a framework that incorporates foreign exchange market pressures under flexible exchange rate systems. The Girton-Roper model, derived from the basic monetary model, suggests that exchange rate fluctuations deviate linearly from inflation differentials, driven by a combination of domestic credit expansion and foreign money supply growth. Consequently, the exchange rate is determined by the fundamental factors of the basic monetary model, further influenced by changes in the components of the monetary base.[5]

Frankel further advanced the monetary approach by integrating the flexible price monetary model with the sticky price model, leading to the development of the real interest rate differential model of the exchange rate. This model incorporates real interest rate differentials as a key explanatory variable in exchange rate determination.

The Hoper-Morton model addressed a key limitation of the monetary approach by incorporating the current account balance as an explanatory variable. This inclusion allows the model to account for the impact of external sector imbalances on exchange rate determination.

The portfolio balance model highlights the complex nature of exchange rate determination. It distinguishes between short-term and long-term exchange rate dynamics, emphasizes the critical roles of monetary and fiscal policies, and considers the influence of current account imbalances and risk premiums. As a result, the composite portfolio balance model is regarded as a more comprehensive framework for exchange rate analysis, as it integrates a broad range of explanatory variables commonly used in the monetary approach.

The currency substitution model introduces a new explanatory variable—currency substitution—which has been largely overlooked in previous monetary models. This model considers the

substitutability between domestic and foreign currency holdings, providing a more comprehensive understanding of exchange rate dynamics.

Economic theories that seek to bridge the gap between the real and monetary sectors examine the transmission mechanisms of monetary policy to the real economy. The exchange rate plays a vital role as a channel through which monetary expansions influence the general price level and economic activity.

Monetarists argue that deflationary policies are unsustainable in the short term, while persistent external imbalances cannot be maintained in the long run. The real exchange rate is determined by three key variables: the nominal exchange rate, domestic prices, and foreign prices. Due to the differing adjustment speeds of these variables, managing the real exchange rate presents a significant challenge.

The monetary Model: [6]

$$[2]M^d - P = \beta_0 Y - \beta_1 i$$

Suppose the model for two open economies,the previous equation is acceptable ti the outside world:

$$[3]M^{d*} - P = \beta_0 Y^* - \beta_1 i^*$$

M^d :domestic money demand

Y : domestic current product

P:the general level of prices

i :nominal interest rate

β_0 :income elasticity

β_1: interest elasticity

[2][3]:from the two equations

$$[4]P - P^* = M - M^* - \beta_0(Y - Y^*) + \beta_1(i - i^*) \quad [7]$$

$$[5]e = P - P^*$$

$$[6]e = m - m^* - \beta_0(y - y^*) + \beta_1(i - i^*)$$

The equation (6) represents the solution

$$[7]e = \beta_1 m + \beta_2 m^* + \beta_3 y + \beta_4 y^* + \beta_5 i + \beta_6 i^*$$

The latter is estimated using simultaneous cointegration

$\beta_1 = +1 , \beta_2 = -1$

$\beta_3 < 0 , \beta_4 > 0$ income elasticites

$\beta_5 < 0 , \beta_6 > 0$ interest elasticites

Within this framework, the real exchange rate is considered to be at parity when purchasing power is fully equalized. While this model serves as a tool for analyzing price competitiveness, the

real exchange rate also plays a crucial role in transmitting monetary policy shocks to the real economy. As a global benchmark for competitiveness, it aids in assessing real resource reallocations across economies.

Monetary economists contend that deflationary policies are ineffective in the short term, as inflation ultimately offsets the competitiveness gains achieved through devaluation. Theoretical explanations link this phenomenon to short-term nominal rigidities in domestic prices and wages. These rigidities are further amplified by exchange rate expectations under expansionary monetary policy, where increased liquidity stimulates domestic demand.

Adjustments in the real exchange rate, intended to enhance foreign demand, are influenced by the differing adjustment speeds of the nominal exchange rate and the price level following devaluation.

In an economy where the public sector is not oriented toward foreign competition, a combination of contractionary monetary policy and expansionary fiscal policy through wage increases would lead to a persistent decline in competitiveness. These policies collectively exert upward pressure on wages, prices, and the real exchange rate, ultimately weakening real competitiveness.

3.1. The applying monetary model to the Algerian dinar:

Monetary analyses are largely theoretical, as they rely on assumptions such as perfect capital mobility and price and wage rigidities. In the case of the Algerian economy, this study aims to examine both the long-term and short-term relationships between the nominal exchange rate and money supply, as well as between the real exchange rate and money supply. However, due to the unavailability of interest rate data, this aspect cannot be analyzed.

The monetary effects on price competitiveness are evaluated by estimating the short-term relationship between the nominal exchange rate, the real exchange rate, money supply growth, and the real economic growth rate.[8]

According to monetary economists, the model that best explains this relationship is as follows:[8] $TCN = TCR + (M - Y) - (M^* - Y^*)$

TCN.nominal exchange rate changes

TCR : real exchange rate changes

$M.M^*$:the growth rate of money supply

$Y.Y^*$: the growth rate of real production

Table (2): estimating the monetary impact on the nominal exchange rate (1970-2022).

R^2	DW	$logY^*$	$logY$	$logM^*$	$logM$	$logTCR$	$logTCN$	
0.89	1.23	1.4	-0.87	-0.39	0.28	0.09	-	$logTCN$
-	-	0.82	-2.62	-1.86	11.52	0.7	-	t-Statistic
0.89	1.75	1.03	-0.8	-0.17	0.32	-	-	$logTCN$
-	-	0.7	-10.4	-1.41	23.52	-	-	t-Statistic

R^2	DW	$logY^*$	$logY$	$logM^*$	$logM$	$logTCR$	$logTCN$	
0.91	1.63	-0.99	-0.85	0..25	0.02	-	0.5	$logTCR$

-	-	-1.58	-2.7	0.8	0.17	-	0.41	t-Statistic
0.91	1.7	-2.7	-1.06	0.19	0.09	-	-	$logTCR$
-	-	-2.65	-10.1	0.63	8.3	-	-	t-Statistic

Source : IFS(2023) estimation method ols Eviews11

M^*Monetary mass

YY^* : Domestic product

Table (3): estimating the monetary impaction the nominal exchange rate (1970-2022).

R^2	DW	$logRY^*$	$logRY$	$logM^*$	$logM$	$logTCR$	$logTCN$	
0.9	1.03	-0.14	-0.48	-0.02	0.33	0.35	-	$dlogTCN$
		(-0.3)	(-1.2)	(-0.2)	(9.77)	(1.17)		t-statistic
0.8	1.85	-0.19	-0.57	-0.01	0.46	-	-	$dlogTCN$
		(-0.4)	(-1.5)	(-0.1)	(10)			t-statistic

Source : IFS(2023) estimation method ols Eviews11.

R^2	DW	$logRY^*$	$logRY$	$logM^*$	$logM$	$logTCR$	$logTCN$	Variables
0.13	1.97	-0.1	-0.16	-0.04	0.3	-	0.1	$dlogTCR$
		(-0.4)	(-0.7)	(-0.6)	(1.3)		(1.17)	t-statistic
0.1	1.79	-0.14	-0.23	-0.14	0.36	-	-	$dlogTCR$
		(-0.5)	(-1.1)	(-0.6)	(1.5)			t-statistic

Source : IFS(2023) estimation method ols Eviews11.

The estimation results provide insights into the evolution of the Algerian dinar's nominal exchange rate by incorporating both domestic and foreign monetary and real variables. Equation [6] demonstrates that 87% of the variations in the nominal exchange rate can be explained by the variables M ,M^* ,RY, RY^*.

This relationship remains robust even when accounting for fluctuations in the real exchange rate, as indicated in Equation [8]. Furthermore, Equations [5] and [6] in Table 3 reveal that the Algerian dinar's nominal exchange rate is significantly impacted by both monetary and real shocks, particularly during periods of rapid money supply expansion. As a result, the nominal exchange rate is expected to depreciate regardless of the economic growth rate, with the effects on the Algerian dinar being most pronounced during phases of monetary policy easing.

Expansionary monetary policy, combined with negative real growth rates, has intensified downward pressure on the nominal exchange rate. To mitigate these effects on the Algerian dinar, the economic growth rate must outpace the expansion of the monetary aggregate significantly.

The sharp increase in the money supply has played a crucial role in shaping the impact of monetary policy on the evolution of the Algerian dinar. Moreover, the period of price controls and their delayed transmission to the real sector hindered the adjustment of demand to inflation induced

by monetary expansion. Conversely, estimates of the real exchange rate indicate a limited influence of monetary policy on its trajectory. This is largely due to the sluggish adjustment of prices to the new monetary environment, resulting in a depreciation of the nominal exchange rate, even within the framework of monetary economic assumptions.

The real exchange rate, which remains uncompetitive in terms of goods flows, fails to adjust accordingly. The persistence of nominal wage-price rigidities, combined with the anticipated monetary expansion of the 1970s and 1980s and the resulting surge in liquidity that stimulated domestic demand, impeded the adjustment of the real exchange rate, even in the short term. This explains the limited impact of monetary policy on the real exchange rate.

3.2: fiscal policy

Expansionary fiscal policy has been recognized as a key driver of inflation and external deficits, making it a central factor in debt accumulation within economies. As a result, structural adjustment efforts during periods of economic downturn should have prioritized controlling, and even reducing, public expenditures.

While fiscal policy objectives address both revenue generation and expenditure management, enhancing revenue levels can be achieved by broadening the value-added tax base, increasing tax efficiency, combating tax evasion, and developing capital market borrowing as an alternative to inflationary financing. However, it is well known that raising tax pressure during economic downturns presents significant challenges, particularly when the objective is to stimulate recovery and exit the recessionary phase.

Moreover, general tax increases contradict liberal economic principles and the objectives of economic recovery. Given the limited capacity of tax administrations to improve tax collection efficiency, fiscal adjustment efforts have primarily focused on expenditure reduction, particularly in the medium and long term.

These efforts have targeted both operating and capital expenditures. Reducing operating expenditures has largely focused on wages and salaries, which constitute the largest portion of current expenditures. The strategy to maintain modest wage levels aimed at controlling public sector employment, freezing salaries in public institutions, or at least preventing full wage indexation to inflation to break the wage-price spiral. The expansion of the wage bill has been a major contributor to excess liquidity, as wage increases have not been linked to productivity growth. Historically, wage dynamics have been more closely tied to the cost of living rather than productivity.

Additionally, the removal of subsidies on essential commodities has been considered a key measure for rationalizing public expenditures. Price liberalization remains a fundamental objective of structural adjustment programs.

These fiscal targets were quantified through expenditure ceilings, subject to revision based on International Monetary Fund (IMF) evaluations. For instance, the second reassessment of the adjustment program set wage and salary expenditures at 9.1% of GDP for the final two years of the extended agreement, with subsequent targets of 10.5% and 10.3% for 1993 and 1994, respectively. Similarly, the price support fund, which previously accounted for 4.9% of GDP, was reduced to 0.8% in 1996 and further limited to 0.6% in the program's final year.

Overall, projections under the Standby Arrangement aimed to reduce the government budget deficit from 5.9% of GDP in 1993 to 0.3% in 1994, while the overall public treasury deficit was

expected to decline from 8.7% to 3.3% by 1996, ultimately reaching 0.6% of GDP in the program's penultimate year.

1.   The first period, from 1989 to 1991, was marked by a commitment to orthodox economic policies and alignment with the International Monetary Fund's (IMF) philosophy.

  2. The second period saw the resurgence of policymakers advocating for an economic nationalist approach. Emphasizing the concept of a "war economy," they aimed to restore national sovereignty in economic decision-making and sought to avoid debt restructuring, which would have increased the country's dependence on the IMF.

3.   The third period commenced with the signing of a Standby Arrangement after a phase of policy suspension. This period subsequently led to the conclusion of a second, "extended" agreement, characterized by a renewed emphasis on fiscal austerity.

4. Conclusion:

The price differential plays a crucial role in determining the equilibrium real exchange rate, making it an essential consideration for monetary authorities in achieving their policy objectives. By accounting for inflation differentials between the domestic and foreign economies, this measure serves as a key benchmark for assessing the relative competitiveness of the domestic economy. It provides insights into the dynamics of supply and demand for both domestic and foreign goods and capital. As a result, this dimension encompasses both the benefits and challenges associated with the real exchange rate.

The key questions that arise are as follows: Does the convergence between domestic and foreign inflation occur under the influence of price liberalization and currency devaluation? Is this convergence affected by the level of economic development? Furthermore, is there a relationship between the evolution of inflation differentials and the determination of the Algerian dinar's exchange rate?

According to our estimates, the coefficients of the variables INFD (Algerian inflation rate) and INFusa (foreign inflation rate) are close to the values predicted by economic theory, specifically +1 and -1, respectively. However, the overall coefficient of determination (R^2) remains weak, implying that inflation differentials in Algeria have not played a significant role in shaping exchange rate policy. Additionally, domestic inflation appears to be largely disconnected from monetary policy, as indicated by the money demand equation.

Before the 1980s, Algeria experienced repressed inflation driven by excessive money creation to finance a persistently growing budget deficit aimed at supporting institutions and investments. Given the rigidity of the production sector, the expansion of the money supply was not accompanied by a proportional increase in goods and services, leading to higher purchasing power and, consequently, rising prices. Since the Algerian dinar did not reflect its true value either domestically or externally, domestic demand continued to grow, exceeding the capacity of domestic production. As a result, economic agents turned to foreign markets, increasing the demand for imports.

Given Algeria's heavy reliance on the hydrocarbon sector, the rising demand for imports resulted in a persistent trade deficit, making external borrowing necessary. When applying the basic monetary model to the Algerian dinar, the estimation results illustrate the evolution of the nominal exchange rate by incorporating both domestic and foreign monetary and real variables. Equation [number] shows that 77% of the variations in the nominal exchange rate can be attributed to these variables. M, M^*, RY, RY^*.

This relationship remains robust even when accounting for fluctuations in the real exchange rate. The findings indicate that variations in the Algerian dinar's nominal exchange rate are

significantly driven by both monetary and real shocks, especially during periods of rapid money supply expansion. As a result, the nominal exchange rate is prone to depreciation irrespective of the economic growth rate, with the most pronounced effects occurring during phases of monetary policy easing.

Expansionary monetary policy, combined with negative real growth rates, has intensified downward pressure on the nominal exchange rate. To mitigate these effects on the Algerian dinar, the economic growth rate must outpace the expansion of the monetary aggregate. The sharp increase in money supply has played a crucial role in shaping the impact of monetary policy on the dinar's trajectory. Additionally, the implementation of price controls and their subsequent transmission to the real sector have impeded the adjustment of demand to inflation induced by monetary expansion.

Conversely, estimates of the real exchange rate indicate a limited influence of monetary policy on its evolution. The absence of price adjustments to the new monetary conditions has led to a depreciation of the nominal exchange rate, even under the theoretical assumptions of monetary economists. Furthermore, the real exchange rate remains unresponsive, reflecting weak competitiveness in terms of goods flows. Nominal wage-price rigidities, along with anticipated monetary expansion during the 1970s and 1980s, and the resulting surge in liquidity that stimulated domestic demand, have constrained the real exchange rate from adjusting, even in the short term. This explains the limited effectiveness of monetary policy in influencing the real exchange rate.

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