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Black Market Exchange Rate, Currency Substitution and Demand for Money

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Abstract: Strict control on foreign exchange and successive devaluation of domestic currency adopted by Algerian government for nearly four decades resulted in black market for foreign currencies, high inflation rates and consequently, lost of confidence in Algarian dinar as a unit of account and store of value. The aforementioned results have given rise to the phenomenon of currency substitution.The aim of this paper is to provide evidence of the existence of currency substitution in Algeria. Using time series data covering the period 1990-2021 and an autoregressive distributive lag (ARDL) model combined with CUSUM and CUSUMQ, the demand for money in Algeria is estimated. Our results point out to the existence of currency substitution when the black market exchange rate is incorporated in the money demand equation. Our findings contribute to the existing litterature on currency substitution issue. As far as policy makers are concerned, the existence of CS could hinder the effectiveness of stabilization policies and thus, means of reducing currency substitution should be devoted.

Keywords: Black market exchange rate, Currency substitution, Demand for money

Introduction

Currency substitution refers to a situation in which domestic currency is totally or partially substituted for foreign one in performing its traditional functions. Individuals may hold foreign currency as a unit of account, medium of exchange and a store of value, a situation referred to as total substitution (Clements & Schwarts, 1992). However, some authors limit the concept of (CS) to the use of foreign currency by domestic residents as a store of value (Calvo & Végh, 1992).

The replacement process, whether partial or complete, expresses a state of loss of confidence in domestic currency at least as a store of value, especially in cases of high-inflation, where individuals' purchasing power is eroded which makes foreign currency more desirable than domestic money. Currency substitution, has been a worldwide phenomenon and has gained much attention in the literature on both developed and developing countries. Factors that influence currency substitution depend largely on capital mobility/or capital restrictions, which are quite different between the two mentioned categories of countries. Generally, a perfect capital mobility, the dominant feature for most developed countries allows residents to hold a portfolio of currencies to minimize the cost of international transactions or to earn a profit if the foreign currency appreciates or the domestic currency depreciates. Currency substitution in most developing countries, arises as a direct consequence of government strict control on foreign exchange, creating therefore, a favorable environment for the development of black market for foreign exchange, the only available outlet for obtaining foreign currency.

Currency substitution phenomenon in some developing countries is fueled by soaring inflation, low nominal interest rates on domestic financial assets, and periodic devaluation of the domestic currency, a climat where foreign currency becomes more desirable as a store of value (Aarle & Buina, 1995).

As regards the effects side of currency substitution, many studies agree on its negative effects on the economy. Boamah, et al. (2012) noted that an increased currency substitution may have some negative spill-off effects such as weakening the autonomy of monetary policy; increasing vulnerability to economic shocks arising from the host country; the potential for deterioration of the balance of payments account or exchange rate volatility; Furthermore, currency substitution has the potential to negatively impact overall economic growth, especially for small open economies(Bahmani Oskooee & Techaratanachai, 2001).

The starting point in handling the algerian currency substitution case is to analyse it within the framework of the shortages of foreign exchange created by the various forms of controls, mainly exchange rates and trade restrictions, imposed on the foreign sector of the economy. One of the significant consequences of these controls is the development of a black market for foreign exchange. An increasing need for foreign exchange has been created by implementing the structural adjustment program imposed by the international monetary fund. Foreign trade liberalization and managed float of the Algerian dinar, were therefore, fundamental factors to expand the activity of the black market for foreign currencies in Algeria. Several currency devaluations were judged as necessary for price liberalization and dinar value correction which was overvalued. The aforementioned procedures have caused high, unprecedented inflation rates, leading to purchasing power erosion and later on to loss of confidence in Algerian dinar. Statistics about black market exchange rate in Algeria bring out an active black market for currencies. According to the latest numbers, the black market premium for the euro currency amounts today to more than 70%. To hedge against inflation and more depreciation of the dinar, many algerians tend to alter their wealth portfolios by substituting foreign money for domestic money. This adjustment takes place mostly in the black market. Thus,the phenomenon of currency substitution, as a store of value in particular, is likely to be more pervasive in Algeria. The purpose of this research is to test for the existence of currency substitution in Algeria through estimating its impact on the demand for money. Although currency substitution is an important issue, it remains unexplored field in Algeria. Therefore, further works on its impact on the algerian economy ; its implications for macroeconomic modeling, exchange rates, and interest rate policies are of extreme importance. After this introduction, the remainder of the paper is organized as follows: section 2 reviews the literature on currency substitution. Section 3 describes the data, methodology and presents the empirical results and section 4 concludes with some policy recommendations.

Literature Review

Considerable amount of attention has been given to the currency substitution issue in both developed and developing countries. This section reviews the pertinent literature that deals with currency substitution in developing countries. Studies that deal with currency substitution fall into two categories. One category aims at investigating the presence and extent of currency substitution while the other is more interested in assessing its impact on a country's economy. Although there are varying approaches to modeling currency substitution, most studies have used a simple money demand function.

The idea of including the exchange rate in the demand for money function as another important determinant, though not tested empirically, was first introduced by Robert mundell (1963). Subsequently, many studies attempted to examine such link empirically, (Arrango & Nadiri, 1981; Domowitz and Elbadawi,1987; Arize, 1989. Bahmani-Oskooee & Pourheydrian, 1990; McNown & Wallace, 1992; Hassan, 1992; Arize & Shwiff, 1993; Chowdhury, 1997; Pozo &Wheeler, 2000).

Mundell's idea was picked up by Arango and Nadiri (1981) who pointed out that traditional studies shortcomings on the demand for money lie in their reliance on local variables only such as permanent income, domestic interest rate and price expectations, thing that may lead to misspecification of the demand for money. The authors concluded that a well specified money demand equation should take into account foreign money developments, such as exchange rate expectations and foreign interest rate. A majority of the studies in the literature have used the model of Arango and Nadiri (1981) or some variant, as the basis for estimating currency substitution.

According to Bahmani-Oskooee (1996), the general consensus in the literature on the demand for money, is that in developed countries, nominal exchange rate represents a suitable cost of holding money whereas in developing countries, due to lack of well-developed financial markets, the cost of holding money is often

proxied by the expected rate of inflation. Therefore, the choices available for asset holders in developing countries are limited to mostly money and goods. Also, investors in these Countries, are constrained to invest in bank deposits and bank bonds, the interest on which are not market determined, they are however, fixed by the countries' monetary authorities for extended time period (Wong,1977; Hassan, 1992). Using a bound testing approach to cointegration, Bahmani-Oskooee and Tanku (2006) estimated the demand for money in 25 LDCs, their results were inconclusive about which rate should enter the money demand equation; the official rate exchange; the black exchange rate or the premium (the gap between official and black). Currency substitution evidence however, was found within four Caribbean countries namely; Guyana, Jamaica and Trinidad and Tobago in Boamah et al. (2012). The authors adopted a variant of traditional money function used by Bahamni-Oskooee and Techaratanachai (2001), Bahamni-Oskooee and Tanku (2006) and Baharumshah et al. (2009). Quarterly data for the period 1996-2006 were used with an ARDL bound testing approach. Harridutt Ramcharran (1990), estimated a money demand equation using data for the period 1973-1987. They pointed out to the existence of currency substitution in Barbados. The phenomenon of currency substitution in LDCs according to the author, is attributed to the black market for foreign currencies, and trade controls imposed by governments:

Data, Methodology and Results

According to the literature on the demand for money, a money demand equation should contain a scale variable to the level of transactions in the economy and a variable representing the opportunity cost of holding money. Furthermore, to account for economic openness, another variable reflecting the relative returns of foreign money vis-à-vis domestic money should be included in the demand for money equation. Since Algeria is a developing country which lacks well developed financial market, the inflation rate is used as a proxy for the opportunity cost of holding money. Following Bahmani-Oskooee (1996) and Bahmani-Oskooee and Rehman (2005) we adopt the following specification:

$$LnM_t = a + LnY_t + cLnP_t + dLnEX_t + \varepsilon_t \qquad (1)$$

Where;

M_t is the desired holdings of real money balances (M_1 or M_2); M_1 consists of currency in circulation and demand deposits in scheduled banks. M_2 consists of M_1 plus quasi money. Y_t is the real GDP; P_t is the consumer price index; EX_t is the exchange rate defined as the number of Algerian dinars per U.S dollar; ε_t is the stochastic disturbance term.

According to macroeconomic theory, the money demand is assumed to be an increasing function of real income (i.e., real GDP), thus, an estimate of b is expected to be positive. Theoretically, estimate of the inflation rate c is expected to be negative. However, what should be emphasized in this regard is that high inflation rates erode the value of domestic currency and would tend to decrease the demand for domestic currency and thus a negative sign of c. Nevertheless, higher inflation rates may also mean higher demand for domestic currency in order to meet required transaction needs yielding a positive sign of c. The impact of inflation on the demand for money is therefore, dependent on the net effect of the two influences. As regards the estimate of d, it could be positive or negative depending on the prevailing effects; the wealth effect or the substitution effect. According to Arango and Nadiri (1981), a depreciation of domestic currency or an increase of foreign currency leads to an increase in value of foreign assets held by domestic residents. If this increase is perceived as an increase in wealth (a wealth effect), then, the demand for money increases yielding a positive estimate of d. Domestic currency depreciation on the other hand, could also result in a decrease of money demand (substitution effect). The so mentioned effect was pointed out in Bahmani-Oskooee and Pourheydarian (1990). They argued that when a currency depreciates, individuals could expect further depreciation and may hold less of domestic currency. In this case, the estimate of d is expected to be negative.

Table 1. Model identification

Model	Identification
Model 1	LnM1, LnGDP, LnCPI, LnOEX
Model 2	LnM1, LnGDP, LnCPI, LnBOX
Model 3	LnM1, LnGDP, LnCPI, LnPR
Model 4	LnM2, LnGDP, LnCPI, LnOEX
Model 5	LnM2, LnGDP, LnCPI, LnBOX
Model 6	LnM2, LnGDP, LnCPI, LnPR

The Two monetary aggregates M_1 and M_2 in equation (1) above are subject to empirical tests, each in three alternatives namely; official exchange rate, black market exchange rate and exchange rate premium. Table 1 below provides an identification of the various alternatives that will be subject to estimation:

The Data

Quarterly data over the period 1990Q1 – 2021Q4 are collected from the international Financial Statistics (IFS) by the IMF. Data on black market exchange rate are collected from other source[1].

The ARDL Estimation Technique

The six models identified in table1 above, will be estimated using a cointegration ARDL bounds testing approach developed by Pesaran (1997) and Pesaran and Shin (1999) and Pesaran et al. (2001). This method has several advantages over conventional methods such as cointegration of Engle and Granger (1997), Johansen (1988) and Johansen and Juselius (1990). First, the ARDL procedure does not require that the series should be integrated of the same order[2] (it can be used for stationary variables and / or integrated of order 1 and / or fractional integration). We note in this context that this procedure cannot be applied to variables with order of integration superior or equal two. Secondly, this procedure has good small sample properties as compared to alternative approaches. In this context, we note that Narayan (2005) has provided critical values for sample sizes ranging from 30 to 80 observations. Third, this procedure allows variables to have different numbers of delay, and provide unbiased long- run estimates with a valid t-statistic even in the case of endogeneity of regressors (Harris & Sollis, 2003). Fourth, unlike conventional methods of cointegration that use a system of equations for estimating long-term relationships, this procedure uses a single equation in the reduced form.

The aim of this study is two folds as it first estimates the long-run income, inflation, and exchange rates (official, black, premium) elasticities of M1 and M2 monetary aggregates and examines their stability and second to test for the existence of currency substitution. However, this will not be sufficient. Laidler (1993) as well as many other authors, point out the importance of the short-run adjustment process. According to them, the short-run modeling of money demand could be a potential source of instability. Thus, incorporating the short –run dynamics into equation (1) leads to an error correction model of the ARDL form following Pesaran et al. (2001):

$$\Delta LnM_t = a_0 + \sum_{i=1}^{n} a_{1i}\,\Delta LnM_{t-i} + \sum_{i=0}^{n} a_{2i}\,\Delta LnY_{t-i} + \sum_{i=0}^{n} a_{3i}\,\Delta LnP_{t-i} + \sum_{i=0}^{n} a_{4i}\,\Delta LnEX_{t-i} + \delta_1 LnM_{t-1} + \delta_2 LnY_{t-1} + \delta_3 LnP_{t-1} + \delta_4 LnEX_{t-1} + \varepsilon_t \quad (2)$$

The operator Δ represents the first difference and εt is a white noise representing the error term. The cointegration bounds testing approach is based on the F statistic or Wald statistic. According to Pesaran et al. (2001), the asymptotic distribution of F is non-standard under the null hypothesis of the absence of long-term relationships between variables, and this regardless of their order of integration if it is (I (0) or I (1)). Based on equation (2), the null hypothesis is $H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$, while the alternative hypothesis (existence of cointegration relations) is $H_1: \delta_1 \neq 0, \delta_2 \neq 0, \delta_3 \neq 0, \delta_4 \neq 0$. To perform the test, Pesaran et al. (2001) provide two sets of critical values, upper and lower. The first (upper) when all variables are integrated of order one (I (1)) and second (lower) when all variables are stationary (I (0)). These two sets of critical values provide a band covering all possible classifications of variables, whether purely I (0), purely I (1) or mutually cointegrated. If the F statistic exceeds the upper band, then the null hypothesis is rejected, then there are cointegration relationships between variables. In case the F-statistic lies between the two bands, while the cointegration test is conclusive (in this case it is necessary to know the order of integration of each variable). And in the case when the F statistic is less than the lower band, the null hypothesis cannot be rejected, therefore there is no cointegration relationship.

Results and Discussion

The cointegration ARDL bounds testing approach requires that the series should have an integration order less than two. Therefore, it is essential to ensure that the order of integration of the variables in the work in hand is less than two. The results of the Augmented Dickey-Fuller (ADF) and Philips Perron (PP) tests of stationarity are presented in Table 2:

Table2. Stationarity test results

	Augmented Dickey-Fuller (ADF)		Philips Perron (PP)		Decision
Series	Level	1st difference	Level	1st difference	I(d)
LnM1	- 1.6008	- 6.5204*	- 1.7142	-11.6796*	I(1)
	[0.4793]	[0.0000]	[0.4218]	[0.0000]	
LnM2	- 3.2359**	- 5.7111	-2.8617***	- 9.4208	I(0)
	[0.0201]	[0.0000]	[0.0527]	[0.0000]	
LnGDP	- 1.7373	- 1.8515***	- 0.5180	- 5.3230*	I(1)
	[0.4100]	[0.0613]	[0.8829]	[0.0000]	
LnCPI	- 5.5392*	-2.0408	-5.0355*	- 7.2474	I(0)
	[0.0000]	[0.0400]	[0.0000]	[0.0000]	
LnOEX	-4.8169*	-8.1831	-5.3409*	-8.2845	I(0)
	[0.0001]	[0.0000]	[0.0000]	[0.0000]	
LnBEX	-2.2125	- 8.9756*	-2.2944	-8.9865*	I(1)
	[0.2029]	[0.0000]	[0.1753]	[0.0000]	
LnPR	-1.3825	-10.7403*	- 1.6690	-10.7824*	I(1)
	[0.8618]	[0.0000]	[0.7595]	[0.0000]	

***, **, * are the MacKinnon critical values for the rejection of the null hypothesis of a unit root at the 1%,5% and 10% levels respectively. Values between brackets are probabilities**.**

According to the results in table2, variables are a mixture of I(0) and I(1). These results represent a suitable rationale for using ARDL approach. the next step in ARDL approach is to test for the existence of a long-run causal relationship between the variables using the bounds test approach developed by Peasran et al. (2001). Since the test is sensitive to the lag length, this latter is determined according to Akaike Information Criterion (AIC). The results of cointegration test are reported in Table 3:

Table3. ARDL Bounds test for cointegration

Null Hypothesis: No Level Relationship					
	F-Statistic	Significance	I(0)	I(1)	Decision
Model 1	11.22956	10%	2.37	3.2	
Model 2	15.05788	5%	2.79	3.67	
Model 3	14.90562	2.5%	3.15	4.08	
Model 4	14.64838	1%	3.65	4.66	Cointegration
Model 5	4.935526				
Model 6	23.68478				

Results of bound tests in table 3 show that the calculated F-statistics are statistically significant (i.e. higher than the upper bound) at 1% level of significance indicating a long run-relationship between variables in the various models. Having the existence of a cointegration relationship between the variables in our models, the next step is to check the long-run coefficients. Table 4 below reports these estimates.

Table 4. Estimated long-run coefficients

		Variables					
Models	Optimum lags	C	LnGDP	LnCPI	LnOEX	LnBEX	LnPR
Model 1	(2,4,4,0)	- 50.84990*	7.885916*	- 0.870238	0.006868	-	-
Model 2	(2,0,4,0)	- 44.66506*	6.085952*	0.949934**	-	- 0.005220*	-
Model 3	(1,0,3,0)	- 44.27246*	6.129775*	0.672352***	-	-	- 0.004793
Model 4	(8,2,1,3)	- 83.74591	9.083529	3.390313	- 0.018757	-	-
Model 5	(1,8,0,3)	- 69.07732*	8.366140***	1.037108	-	0.015482	-
Model 6	(1,4,1,3)	58.31740	- 6.709433	2.344735	-	-	- 0.055674

***, **, * indicate significance at the 1%,5% and 10% levels respectively.

As can be seen, all variables carry their expected signs and significance at 1% level of significane when the black-market exchange rate(BEX) is included in the demand for money equation M1(model 2). Such high significance diminishes with the inclusion of the official exchange rate and disappears totally when the money demand equation M2 is used. As far as currency substitution is concerned, the correct, negative sign and the significance of the black-market exchange rate confirm the substitution effect for the Algerian case. In fact, many algerians, use the algerian black market for foreign currencies to substite national

currency for foreign one, getting therefore, benifit from the continueous devaluation of the algerian dinar. The aforementioned results are extremely important as they point out first, more stability in monetary aggregate M1 by including black-market exchange rate and second, evidence for currency substitution steming from black market for foreign currencies in Algeria. As mentioned previously, the short-run modeling of money demand could be a potential source of instability. Thus, short-run coefficients estimates should be considered. To this end, the long-run coefficient estimates are used to form error-correction term ECM by substituting the lagged level variables in (2) by lagged error-correction term ECM and estimate the model again by imposing the optimum number of lags determined before. A negative and significant coefficient obtained for ECM is a more efficient way of establishing cointegration. As can be seen from Table 5, indeed ECM carries its expected negative and significant coefficient in M1 models, supporting cointegration among all variables. Finally, we perform the CUSUM and CUSUMSQ tests to the residuals. As it is clear the CUSUM and CUSUMSQ tests in figure1 support stability of M1.

Table 5. Estimated short-run coefficients

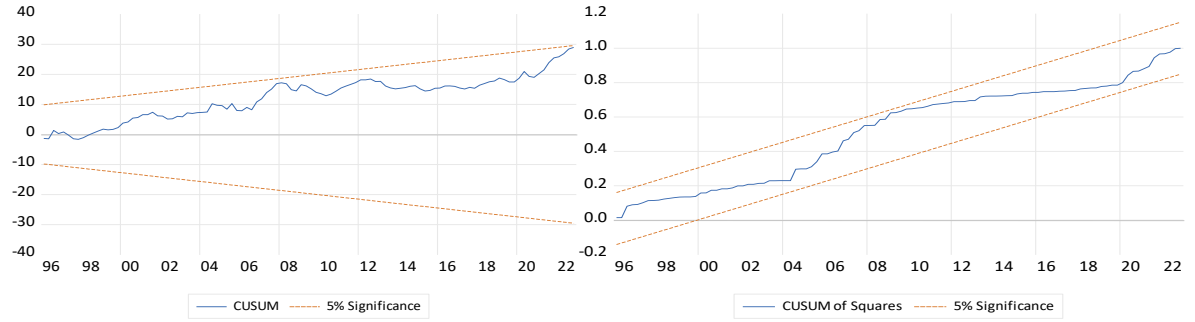
	Models					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
C	- 0.963386	- 1.755169	- 1.841403	0.731735	1.089937	0.503035
LnM1(-1)	- 0.018946	- 0.039296	- 0.041593	-	-	-
ΔLnM1(-1)	- 0.166646	- 0.142275	- 0.134325	-	-	-
LnGDP(-1)	0.149404	0.239155	0.254953	- 0.079368	- 0.132005	
ΔLnGDP	1.444677	1.132744	1.142319	0.934770	0.423876	- 0.057874
ΔLnGDP(-1)	0.666928	0.456004	0.455912	-	-	-
ΔLnGDP(-2)	- 0.633545	- 0.935181	- 0.931598	-	-	-
ΔLnGDP(-3)	- 1.231050	- 0.853009	- 0.815584	-	-	-
LnCPI	-	0.037329	0.027965	-	-	-
LnCPI(-1)	0.016487	-	-	- 0.029623	- 0.016364	0.020225
ΔLnCPI	- 0.207039	-	-	0.048534	0.001619	0.188079
ΔLnCPI(-1)	0.211803	-	-	0.172591	0.280490	0.225661
ΔLnCPI(-2)	- 0.371639	-	-	- 0.029623	- 0.372283	- 0.199129
ΔLnCPI(-3)	- 0.167970	-	-	-	-	-
ΔLnCPI(-4)	0.288477	-	-	-	-	-
ΔOEX	- 6.87E-05	-	-	0.000220	-	-
OEX(-1)	0.000130	-	-	0.000164	-	-
ΔOEX(-1)	- 0.000537	-	-	- 0.001974	-	-
ΔOEX(-2)	- 0.000796	-	-	- 7.08E-05	-	-
ΔOEX(-3)	- 0.004944	-	-	- 0.002058	-	-
ΔLnOEX	-	-	-	-	-	-
ΔLnOEX(-1)	-	-	-	-	-	-
ΔLnOEX(-2)	-	-	-	-	-	-
ΔLnOEX(-3)		-	-	-	-	-
BEX	-	- 0.070205	-	-	- 0.000244	-
PR	-	-	- 0.000199	-	-	-
LnM2(-1)	-	-	-	0.008738	0.015779	- 0.008626
ΔLnM2(-1)	-	-	-	-	0.069482	-
ΔLnM2(-2)	-	-	-	-	0.158129	-
ΔLnM2(-3)	-	-	-	-	- 0.069585	-
ΔLnM2(-4)	-	-	-	-	- 0.158587	-
ΔLnM2(-5)	-	-	-	-	0.107245	-
ΔLnM2(-6)	-	-	-	-	- 0.068496	-
ΔLnM2(-7)	-	-	-	-	- 0.195745	-
PR(-1)	-	-	-	-	-	- 0.000480
Δ PR	-	-	-	-	-	0.000354
Δ PR (-1)	-	-	-	-	-	0.000747
ECM(-1)	- 0.035229*	- 0.041572*	- 0.0034768*	0.023452	0.011415	0.002045

Conclusion and Policy Recommendations

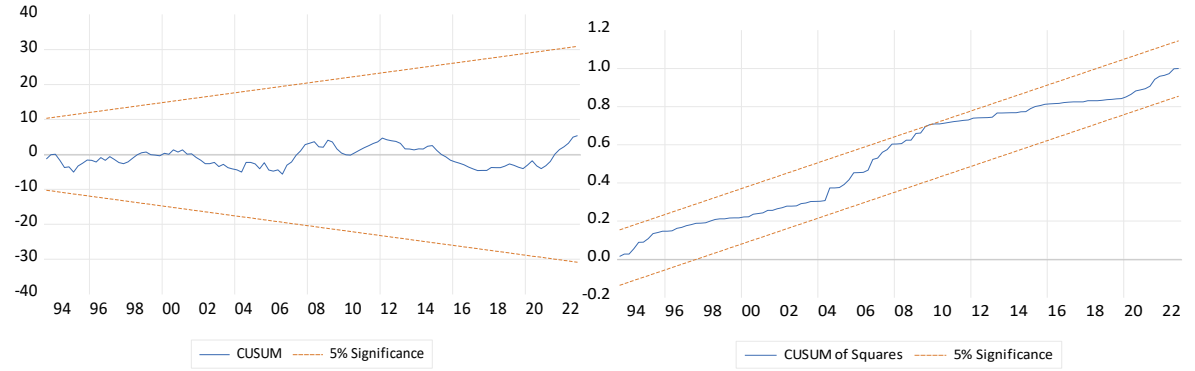
Currency substitution - the partial or total use of foreign money in fulfilling money traditional functions- is a worldwide phenomenon. Due to its effects on the formulation of effective macroeconomic policies, has been

given much attention in the literature for both developed and less developed countries. Unlike developed countries Currency substitution in most developing countries, arises as a direct consequence of government strict control on foreign exchange. Strict control on foreign exchange and successive devaluation of domestic currency adopted by Algerian government for nearly four decades resulted in black market for foreign currencies, high inflation rates and consequently, lost of confidence in Algarian dinar. Naturally, in a country like Algeria, the phenomenon of currency substitution, as a store of value in particular, is likely to be more pervasive as individuals use foreign currencies as a mean to hedge against inflation. In an attempt to test for the existence of currency substitution in Algeria, we estimated the money demand function. Our findings are extremely important and deserve more attention as they point out the existence of currency substitution in Algerian case. As far as policy makers are concerned, and for a successful and effective monetary policy, the monetary authorities would rather concentrate on M1 because not only is it cointegrated with its determinants and it is stable.

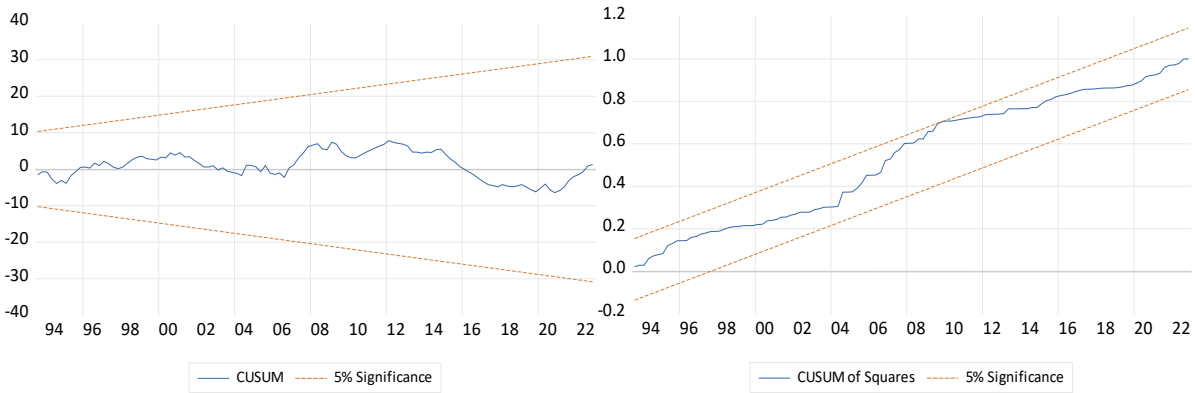
Model 1. LnM1,LnOEX,LnGDP ,LnCPI



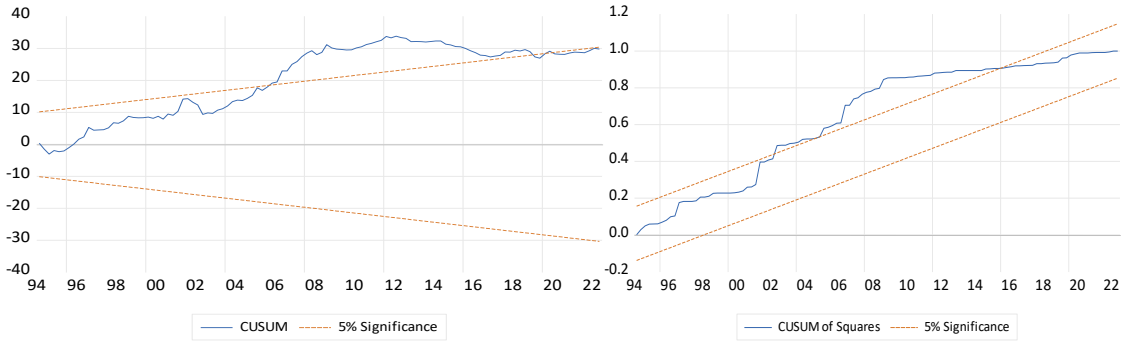
Model 2. LnM1,LnBEX,LnGDP ,LnCPI



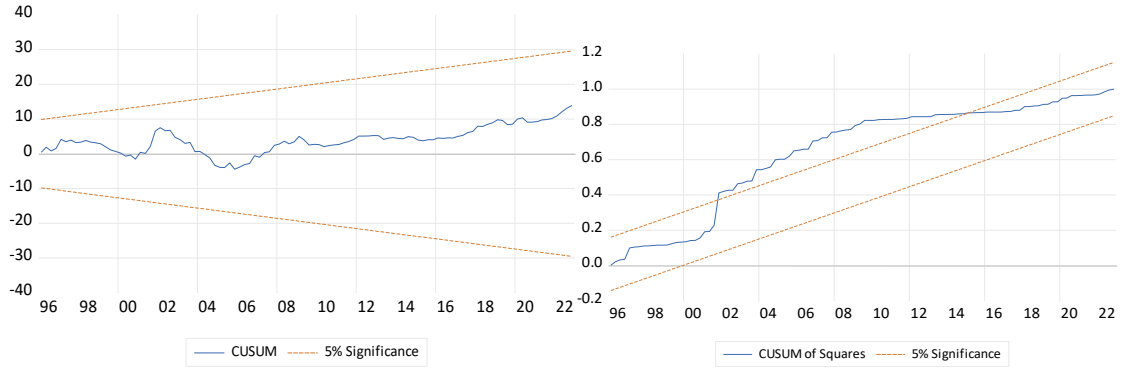
Model 3. LnM1,LnPR,LnGDP ,LnCPI



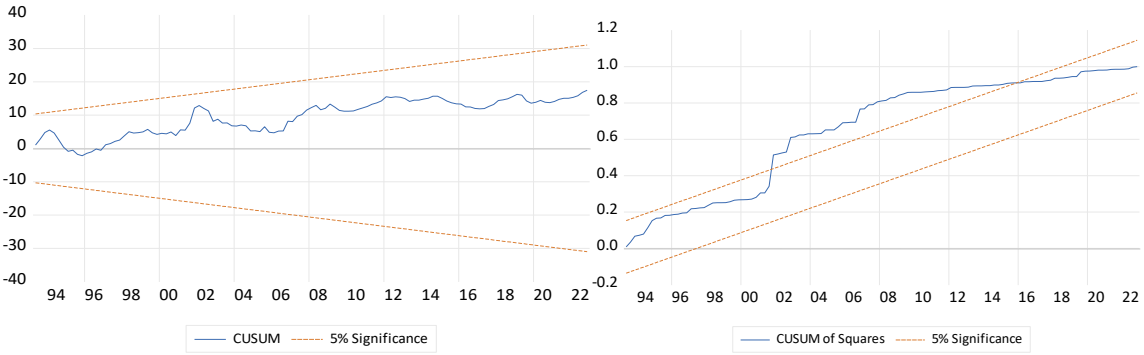
Model 4. LnM2, LnOEX,LnGDP ,LnCPI



Model 5. LnM2, LnBEX ,LnGDP ,LnCPI



Model 6. LnM2,LnPR,LnGDP ,LnCPI



Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

Acknowledgements or Notes

* This article was presented as an oral presentation at the International Conference on Social Science Studies (www.iconsos.net) held in Alanya/Turkey on May 02-05, 2024

* [1]Data on black market exchange rate for the period 1990Q1- 2003Q4 are collected from http://www.puaf.umd.edu/ faculty /reinhart/OFFICIAL_PARALLEL_DATABASE1.xls. Those for the period 2004Q1- 2021Q4 however, are collected from dealers in black market for currencies in Algeria.

* [2] This advantage is very important when testing variables with different order of integration.

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