Determinants of exchange rate regime choise in Algeria,

evidence from binary Logit and Probit model

Zerbout Amina [*] [(1)]

aminazrbt1@gmail.com

Faculty of Economic Sciences, Management and Commercial Sciences, Lounici Ali University, Blida 2, (Algeria).

kara Brahim [(2)]

Brahim.Kara@univ-relizane.dz

Faculty of Economic Sciences Management and Commercial Sciences, University of Relizane, (Algeria).

Hebbal Adel [(3)]

a.habbal@univ-djelfa.dz

Faculty of Economic Sciences, Management and Commercial Sciences,

Laboratory of quantitative methods in economic sciences and business administration sciences and their applications for sustainable development,

Ziane Achour University ,Djelfa, (Algeria).

[*] Corresponding author: aminazrbt1@gmail.com

Abstract

This research studies the determinants of the choice of exchange rate regime in Algeria over the 1980-2021 period . We run logit and Probit regressions using the following variables :, the dummy variable, the exchange rate regime as a dependent variable, the exchange rate, trade openness, inflation rate, foreign exchange reserves and GDP growth rate as independent variables., The results obtained confirmed that exchange rate, the trade openness and the inflation rate have a significant impact on the choise of exchange rate regime for the Algerian economy.

Keywords: Exchange rate, Exchange rate regime, Logit model, Probit model, Algeria.

JEL Classification: E52, E58, Q3.

1. INTRODUCTION

International monetary and financial relations have imposed on the world the creation of a regulatory framework for international monetary transactions, in order to control economic imbalances at the local and international levels, where interest in the exchange rate occupies a forefront place in this regulatory framework, because the exchange rate is the main axis that guarantees the stability of the international monetary system.

That is why economic researchers attached great importance to choosing the exchange system that ensures the achievement of internal political and economic goals on the one hand, and protects the national economy from exposure to external shocks on the other hand.

Economic theory also indicates that creating the economic balance of any country depends primarily on the exchange system adopted in those countries.

The choice of the exchange rate system is one of the most relevant economic decisions that any economic authority must face at the present time, as Fränkel

believes in 1999 that "there is no perfect exchange system, but rather there is an ideal exchange system specific to each country." This shows the importance of determinants Choosing the exchange rate system and addressing these determinants through economic literature.

1.1. The main problem:

Based on the foregoing, the problematic of this study emerges, which calls us to ask the main question the next:

What are the determinants of the exchange rate in Algeria?

1.2. Sub questions:

Through this problem, we will try to answer the following sub-questions:

- What is the relationship of the exchange rate system with foreign trade?

- Is there a statistically significant relationship between the exchange rate regime and the inflation rate in Algeria?

- What are the specific theories of the exchange rate and how effective are they for Algeria?

1.3. Literature review:

 - Study (**M. Daly & Mouley, 2009**)**,** Determinants of Exchange Rate Practices in the MENA Countries: Some Further Empirical Results.

This study was presented as an article for the William Davidson Institute Working Paper Number 952.

This paper analyses the determinants of exchange rate practices in 15 MENA countries for the 1977-2007 period placing special emphasis on structural and macroeconomic explanations. The study uses three different exchange rate regime classifications in order to avoid potentially misleading specification.

Even though the empirical results using the de facto classifications are very different from those obtained from the de jure specification, The study found that that

international reserves play a major role in determining exchange rate practices in the MENA countries.

- Study **(Álvarez Ondina, Pérez Rivero, Vicente Queijeiro, & Vicente Cuervo, 2011),** The determinants of the choice of exchange rate regimes in Latin America: a mixed multinomial logit approach.

This study was presented as an article for the Cuadernos de economía Journal.

The choice of the exchange rate regime is one of the most signifi cant monetary policy decisions that any economic authority has to make nowadays. Indeed, there have been many studies from a theoretical and empirical point of view, but the only common conclusion would be the lack of consensus. In the past this topic has been modeled by binary probit or cross-sectional multinomial logit models, both of which have weaknesses in the assumptions of the choices. in this study such issue is faced by means of a panel mixed multinomial logit model, which allows for substitution pattern among the three types of exchange rate regimes: fi xed, intermediate, and fl exible. Three types of choice determinants are explored: those stated by the Optimum Currency Area (OCA) theory, types of shocks and vulnerability to currency crises, using a sample of 21 Latin American countries over the period 1980-2004.

- Study **(Aliyev, 2014),** Determinants of the Choice of Exchange Rate Regime in Resource-Rich Countries.

This study is a Working Paper Series 527.

This research studies the specifie determinants of the choice of exchange rate regime in resource-rich countries. He turned multinomial logit regressions for an unbalanced panel data set of 145 countries over the 1975-2004 period. We find that resource-rich countries are more likely to adopt a fixed exchange rate regime copared to resource-poor countries.

Furthermore, The study provides evidence that output volatility contributes to the likelihood of choosing a fixed exchange rate regime positively in resource-rich countries and negatively in resource-poor countries. And he believes that in resource-

rich countries a fixed exchange rate regime is mainly preferred due to its stabilization function in the face of turbulent foreign exchange inflows. Moreover, The results of the study reveal reveal that the role of democracy and independent central banks in choosing more flexible exchange rate regimes is stronger in resource-rich countries. In resource-rich countries that possess non-democratic institutions and non-independent central banks, the government is less accountable in spending natural resource revenues and fiscal dominance prevails. In this situation, fluctuations in natural resource revenues are more easily transmitted into the domestic economy and therefore fixed exchange rate becomes a more favorable option.

- Study **(Abila & Louchan, Determinants of the exchange rate and conditions for the success of currency devaluation as a policy to stimulate exports, 2018),** Determinants of the exchange rate and conditions for the success of currency devaluation as a policy to stimulate exports.

 This study was presented as an article for the el Modaber Journal, Issue 6.

The article aims to analyze the relationship between the exchange rate and the level of exports of various products. This study sheds light on the financial aspect in its part related to exchange rates and highlighting its role as an effective tool in stimulating and pushing exports. The topic also derives its importance at a time when Algerian exports outside hydrocarbons are witnessing an unprecedented decline. Due to the inability of the national crowned to compete with foreign products.

- Study **(Maraoui, Thouraya, Khefacha, & Rault, 2021),** How do economic political, and institutional factors influence the choice of exchange rate regimes ? new evidence from selected MENA countries.
This study is a Working Paper No 1498
This study, investigates how economic, political, and institutional factors affect the choice of exchange rate regimes using data on eight Middle East and North Africa (MENA) countries over the 1984-2016 period. Specifically, we run random-effects

ordered probit regressions of the likelihood of exchange rate regimes on the potential determinants of exchange rate regimes.

Three important findings emerge from the analysis. The first finding is that political and institutional factors play an important role in determining the exchange rate regime in MENA countries, where a democratic political regime and a low level of corruption increase the probability of opting for a fixed regime, while strong governments, political stability (such as less internal conflicts and more government stability), more law and order enforcement, and a left-wing government decrease the probability of opting for a fixed regime. The second finding is that bureaucracy, independent central banks, elections, terms of trade, and monetary independence have no effect on the choice of exchange rate regimes. The third finding is that financial development is not a robust determinant of the choice of exchange rate regimes. Our results still hold when considering alternative specifications, and they have important implications for policymakers in MENA countries.

2. EXCHANGE RATE REGIME CHOISE DETERMINNANTS (THEORY)

Mundell's (1961) theory of Optimum Currency Areas (OCA) predicts that fixed exchange rates are most appropriate for countries that are closely integrated through international trade and factor movements , , a high degree of internal factor mobility and a low inflation differential relative to its main trading partners. In these cases there is less need for exchange rate adjustment.

On the other hand, flexibility is more appropriate for countries exposed to real shocks (such as terms of trade movements) – Broda (2004) finds that output recovers significantly more slowly from negative terms-of-trade shocks in developing countries when exchange rates are fixed.

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Table1. Survey of explanatory variables in empirical literature (a positive coeffi cient indicates a trend towards a fl exible exchange rate regime)

	Explanatory variables	**Positive +**	**Negative -**	**Non Significant**	**Total**
Optimum Currency area Theory Factors	Openness	12	19	10	41
	Economic development	10	5	6	21
	Size of the economy	21	2	5	28
	Infl ation differential	5	2	5	12
	Capital mobility	0	4	3	7
	Geographical trade concentration	5	9	7	21
	International financial integration	5	2	4	11
Other factors (macro, external and estructural)	Growth	4	3	1	8
	Negative growth	1	1	0	2
	Infl ation	8	3	4	15
	Moderate to high infl ation	2	4	0	6
	Reserves	4	9	10	23
	Capital control	4	5	6	15
	Terms of trade volatility	3	2	4	9
	Variability in export growth	2	0	0	2
	External variability openness	0	1	0	1
	Real exchange rate volatitlity	3	2	1	6
	Product diversifi cation	3	3	3	9
	Current account	2	3	1	6
	External debt	5	6	0	11
	Growth of domestic credit	5	4	1	10
	Money shocks	2	3	1	6
	Foreign price shocks	2	0	1	3
	Financial development	4	4	1	9
	Fiscal balance	0	2	0	2
	Central government balance	0	0	2	2
Historical and political factors	Political instability	10	1	4	15
	Central bank independence	1	0	1	2
	Party in office has majority	2	4	0	6
	Number of parties in coalition	1	0	1	2
	Coalition government	1	0	2	3
	Political regime (Dem/Dic)	4	1	2	7
	Electoral system (proportional / M)	2	0	0	2
	Expansive fiscal policy	0	1	0	1

Source : Alvares et al (2007)

Table 2. Determinants of exchange rate regime choise

Exchange rate regime / Determinants	fixed exchange rate regime	intermediate exchange rate regime	floating exchange rate regime
Degree of openness	+	-	+ +
financial development	+ +	-	+ +
Shock adjustment	+	-	+ +
policy credibility	+ +	++	-
Inflation	+ +	-	+
GDP growth	+ +	-	+ +
competitiveness of the economy	-	-	+ +
Internatonal trade	+ +	-	+

++(high positive effect) , +(positive effect) , -(negative effect)

Source : Alvares et al (2007)

**Figure 1.** Exchange rate regime in algeria (1980 – 2021)

Exchange rate evolution (1980 – 2021) Algeria
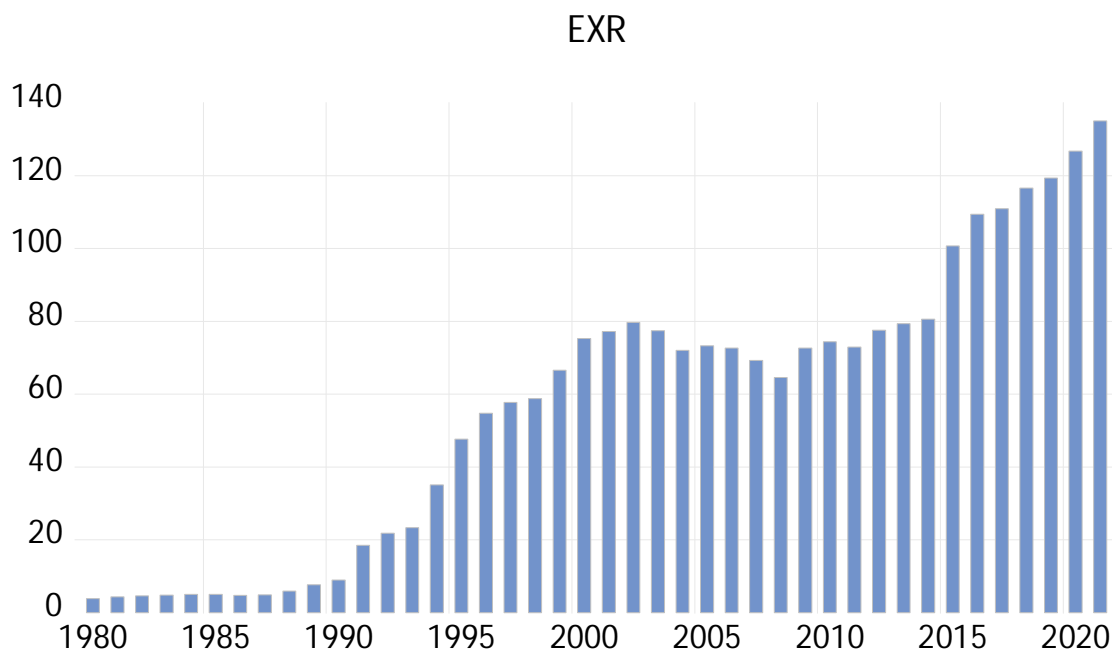
Source : www.worldbank.org

From the figure we can see that the average of exchange rate is about 56 in the (1980 – 2021) period , before the devauluation policy adopted by algeria in 1994 the average of exchange rate was only 8,34 , In this period the exchange rate regime was fixed to a basket of currencies . After 1994 , the exchange rate regime adopted by Algeria became the managed float

Figure 2. Evolution of exchange rate and Inflation in Algeria over the period (1980-2021)
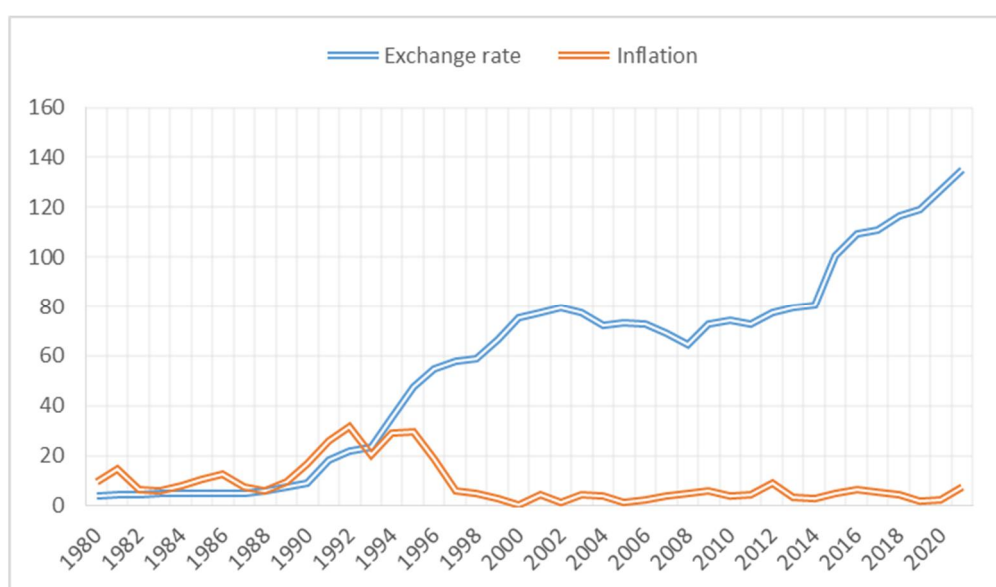
Source : www.worldbank.org

3. MODEL SPECIFICATION AND EMPIRICAL RESULTS

3.1. The model specification

Logit and Probit Model

We can think of y^* as the underlying latent propensity that y=1

$$y^* = \alpha + \beta X + \varepsilon$$

$$\begin{cases} \mathbf{1} \; if \; y^* > \gamma \\ \mathbf{0} \; if \; y^* \leq \gamma \end{cases}$$

Where γ is the threshold

Since y* is unobserved, we use do not know the distribution of the errors, ε

In order to use maximum likelihood estimation (ML), we need to make some assumption about the distribution of the errors.

Logit versus Probit

Logit model

$$ln\left(\frac{pi}{1-pi}\right) = \sum_{k=0}^{k=n} \beta_k\, x_{ik}$$

Standard logistic distribution of errors

Probit model

$$\phi^{-1}(p_i) = \sum_{k=0}^{k=n} \beta_k\, x_{ik}$$

Normal distribution of errors

There are many variables that are essential in explaining exchange rate regime choice , however it is not possible to include all of them. The variables in this study were chosen because of their importance especially in Algeria and availability of data, the econometric model is specified as

$$ERR = f(INFL\,,OPEN\,,GDP\,,RESERVE\,,EXR)$$

Variable	Explanation
ERR	Exchange rate regime
GDP	Gross domestic product (growth rate)
INFL	Inflation rate (% change of consumer prices index)
EXR	exchange rate
OPEN	Degree of openness ($\frac{export+import}{Gdp}$)
RESERVE	Foreign exchange reserves minus gold (billions of dollars)

3.2.   Unit root test

The Augmented Dickey–Fuller (ADF) (1979, 1981) is used to determine the presence of unit roots in the data sets. The ADF test is based on the estimate of the following regression:

$$\Delta X_t = \delta_0 + \delta_1 t + \delta_2 X_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta X_{t-i} + u_i$$

where, Δ is the first-difference operator, X_t is the observations of the series, δ_0, δ_1, δ_2, and α_i are being estimated and u_t is the error term. The null and the alternative hypothesis for the existence of unit root in variable X_t is: $H_0:\delta_2=0$ against $H_\varepsilon:\delta_2<0$.

The ADF test results indicates that GDP, INFL and OPEN are integrated of order I(0) , RESERVE and EXR are integrated for order one I (1)

Table 3. Correlation matrix

Correlation matrix					
	INFL	*OPEN*	*GDP*	*D(RESERVE)*	*D(EXR)*
INFL	*1.000000*				

OPEN	*-0.348427*	*1.000000*			
	-2.321396	*-----*			
	*0.0256****	*-----*			
GDP	*-0.283054*	*0.459896*	*1.000000*		
	-1.843045	*3.234389*	*-----*		
	*0.0729***	*0.0025*****	*-----*		
D(RESERVE)	*-0.008994*	*0.249532*	*0.074630*	*1.000000*	
	-0.056173	*1.609234*	*0.467369*	*-----*	
	0.9555	*0.1156*	*0.6428*	*-----*	
D(EXR)	*0.308335*	*-0.155451*	*-0.192977*	*-0.382555*	*1.000000*
	2.024175	*-0.982735*	*-1.228224*	*-2.585744*	*-----*
	*0.0498****	*0.3318*	*0.2267*	*0.0136****	*-----*

*significant at 10% level , **significant at 5 % level , ***significant at 1% level*

Source : Authors based on Eviews 12

From the correlation matrix between variables we can see that:

The openess is negatively correlated with the inflation rate , this effect is statistically significant at 5 % level , also the exchange rate is positivelly correlated with inflation at 10 % level of significance, morever the correlation between GDP and openess is positive ans statistically significant at 1 % level of significance this results are consistent with theoretical background.

Table 4. Logit and Probit model (estimation results)

Independent Variables	Logit model Estimation	Probit model Estimation
C	-10,03 (0,0571)*	-6,0008 (0,0538)*
INFLATION	-0,4833 (0,048)**	-0,2774 (0,0469**
OPEN	0,2552** (0,0261)	0,1506** (0,0237)
GDP	-0,146 (0,6322)	-0,0848 (0,6294)
D(RESERVE)	$2,68^{E}$-16 (0,736)	$1,50^{E}$-16 (0,7601)
D(EXR)	0,975** (0,0286)	0,5653** (0,0267)
McFadden R^2	0,648	0,653
LR statistic	33,19	33,48
Prob LR statistic	0,0000	0,0000

*significant at 1% , **significant at 5 %

Source : Authors based on Eviews 12

The estimation results of the logit model can be interpreted as :

The impact of inflation on the choise of ecxchange rate regime is about -0.277490 % at 5% level of significance **,** meaning that the choise of exchange rate regime is influenced by inflation rate , The negative sign on the coe-cient of inflation indicates that higher rates of inflation lower the likelihood of a fixed regime. this results are consistent with theoretical background.

We also note that the exchange rate have a significant impact on the choice of the exchange rate system.

We also confirm that Openness is important determinants of exchange rate regime choise in Alegria.

4. CONCLUSION

In this research we analyze the determinants of the choice of exchange rate regime in Algeria over 1980-2021 period using logit and Probit model ., we confirm exchange rate , openness, and inflation rate are important determinants of the choice of exchange rate regime in Algeria.

We observe that inflation is important determinant of the choice of exchange rate regime according to Logit and Probit mode results , in this case a fixed exchange rate system would be optimal , also the significant impact of trade openness indicates that the system of floating the exchange rate is more appropriate in order to absorb external shocks.

On the other hand, it can be concluded that exchange rate changes are considered one of the main determinants of the exchange rate system in Algeria , and these results are consistent with the hypotheses of economic theory.

Moreover, our results reveal that Algeria is more likely to adopt a fixed exchange rate regime. We think that on the background of large and volatile foreign exchange inflows and high inflation rate , pegging exchange rate might have a rationale.

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6. Appendix

Table1. Goodness-of-Fit Evaluation for Binary Specification

Goodness-of-Fit Evaluation for Binary Specification
Andrews and Hosmer-Lemeshow Tests
Equation: EQ02
Date: 05/06/23   Time: 00:22
Grouping based upon predicted risk (randomize ties)

	Quantile of Risk		Dep=0		Dep=1		Total	H-L
	Low	High	Actual	Expect	Actual	Expect	Obs	Value
1	9.E-09	0.0014	4	3.99859	0	0.00141	4	0.00141
2	0.0041	0.1851	4	3.64557	0	0.35443	4	0.38888
3	0.2714	0.4242	2	2.69209	2	1.30791	4	0.54415
4	0.4819	0.6057	2	1.78221	2	2.21779	4	0.04800
5	0.7133	0.9026	1	0.78668	3	3.21332	4	0.07200
6	0.9664	0.9941	0	0.08674	4	3.91326	4	0.08867
7	0.9968	0.9996	0	0.00779	4	3.99221	4	0.00780
8	0.9998	0.9999	0	0.00062	4	3.99938	4	0.00062
9	1.0000	1.0000	0	1.7E-05	4	3.99998	4	1.7E-05
10	1.0000	1.0000	0	7.1E-07	5	5.00000	5	7.1E-07
		Total	13	13.0003	28	27.9997	41	1.15156

H-L Statistic	1.1516	Prob. Chi-Sq(8)	0.9971	
Andrews Statistic	17.8452	Prob. Chi-Sq(10)	0.0576	

Table 2. Binary Probit

Dependent Variable: ERR
Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)
Date: 05/06/23   Time: 00:22
Sample (adjusted): 1981 2021
Included observations: 41 after adjustments
Convergence achieved after 8 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-6.000811	3.111402	-1.928652	0.0538
OPEN	0.150621	0.066597	2.261670	0.0237
INFL	-0.277490	0.139641	-1.987168	0.0469
GDP	-0.084858	0.175856	-0.482542	0.6294
D(RESERVE)	1.50E-16	4.90E-16	0.305342	0.7601
D(EXR)	0.565319	0.255201	2.215189	0.0267

McFadden R-squared	0.653753	Mean dependent var	0.682927
S.D. dependent var	0.471117	S.E. of regression	0.297426
Akaike info criterion	0.725245	Sum squared resid	3.096175
Schwarz criterion	0.976012	Log likelihood	-8.867531
Hannan-Quinn criter.	0.816561	Deviance	17.73506
Restr. Deviance	51.22077	Restr. log likelihood	-25.61039
LR statistic	33.48571	Avg. log likelihood	-0.216281
Prob(LR statistic)	0.000003		

Obs with Dep=0	13	Total obs	41
Obs with Dep=1	28		

Table 3. Binary Logit

Dependent Variable: ERR
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 05/06/23   Time: 00:24
Sample (adjusted): 1981 2021
Included observations: 41 after adjustments
Convergence achieved after 8 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-10.03297	5.273037	-1.902694	0.0571
OPEN	0.255260	0.114774	2.224013	0.0261
INFL	-0.483316	0.244373	-1.977782	0.0480
GDP	-0.145003	0.302970	-0.478605	0.6322
D(RESERVE)	2.68E-16	7.96E-16	0.337194	0.7360
D(EXR)	0.975354	0.445661	2.188555	0.0286

McFadden R-squared	0.648094	Mean dependent var	0.682927
S.D. dependent var	0.471117	S.E. of regression	0.298484
Akaike info criterion	0.732314	Sum squared resid	3.118240
Schwarz criterion	0.983081	Log likelihood	-9.012439
Hannan-Quinn criter.	0.823630	Deviance	18.02488
Restr. Deviance	51.22077	Restr. log likelihood	-25.61039
LR statistic	33.19589	Avg. log likelihood	-0.219816
Prob(LR statistic)	0.000003		

Obs with Dep=0	13	Total obs	41
Obs with Dep=1	28		

Table 4. Categorical Descriptive Statistics for Explanatory Variables

Categorical Descriptive Statistics for Explanatory Variables
Equation: EQ02
Date: 05/06/23   Time: 00:24

		Mean	
Variable	Dep=0	Dep=1	All
C	1.000000	1.000000	1.000000
OPEN	48.60161	60.21771	56.53456
INFL	13.50315	6.398302	8.651057
GDP	2.038461	2.878571	2.612195
D(RESERVE)	-2.62E+08	1.88E+09	1.20E+09
D(EXR)	1.500612	3.989952	3.200649

		Standard Deviation	
Variable	Dep=0	Dep=1	All
C	0.000000	0.000000	0.000000
OPEN	9.207699	8.545951	10.23136
INFL	8.169083	7.297675	8.195844
GDP	2.899581	2.291265	2.494514
D(RESERVE)	8.23E+08	3.26E+15	2.68E+15
D(EXR)	2.601150	5.671987	5.012076
Observations	13	28	41

Table 5. Expectation-Prediction Evaluation for Binary Specification

Expectation-Prediction Evaluation for Binary Specification
Equation: EQ02
Date: 05/06/23   Time: 00:24
Success cutoff: C = 0.5

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
P(Dep=1)<=C	10	3	13	0	0	0
P(Dep=1)>C	3	25	28	13	28	41
Total	13	28	41	13	28	41
Correct	10	25	35	0	28	28
% Correct	76.92	89.29	85.37	0.00	100.00	68.29
% Incorrect	23.08	10.71	14.63	100.00	0.00	31.71
Total Gain*	76.92	-10.71	17.07			
Percent Gain**	76.92	NA	53.85			

Estimated Equation	Constant Probability

	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
E(# of Dep=0)	9.99	3.01	13.00	4.12	8.88	13.00
E(# of Dep=1)	3.01	24.99	28.00	8.88	19.12	28.00
Total	13.00	28.00	41.00	13.00	28.00	41.00
Correct	9.99	24.99	34.97	4.12	19.12	23.24
% Correct	76.81	89.24	85.30	31.71	68.29	56.69
% Incorrect	23.19	10.76	14.70	68.29	31.71	43.31
Total Gain*	45.11	20.94	28.60			
Percent Gain**	66.05	66.05	66.05			

*Change in "% Correct" from default (constant probability) specification
**Percent of incorrect (default) prediction corrected by equation