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Article

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What are the main factors driving behind the MENA countries current account deficit? A panel logit approach analysis

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ABSTRACT

The sustained current account deficit in any country has an important implication for policy. If it continues, then it suggests that the regime ought to have no motivation to avoid or to diminish its international debt. In this paper, we test empirically the relationship among current account deficit and different macroeconomic variables by using panel Logit model. Therefore, we focus on the MENA countries during the years of 1980-2017. We built an econometric model to analyse the contribution of the real GDP, unemployment rate (UR), consumer price index (CPI), export growth rate (EGR), import growth rate (IGR), public expenditures (PE), and foreign trade rate (FTR) on current account deficit (CAD). We established that only the following exogenous variables: GDP, UR, PE and FTR have a positive and significant effect on the current account deficit. This outcome may support governments to identify the best time for investment and business strategies by observing the evolution of the performance of higher temporal hierarchy industries.

Keywords: current account deficit, panel Logit model, MENA countries, macroeconomic variables.

JEL classification: C13; C23; C51; C52; C55; C58; G17; G18; G28.

MSC2010: 91G70; 62P20; 91G80; 70G99; 47N30.

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¿Cuáles son los principales factores que impulsan el déficit de cuenta corriente de los países MENA? Un análisis de enfoque de panel Logit

RESUMEN

El déficit sostenido de la cuenta corriente en cualquier país tiene una implicación importante para la política. Si continúa, sugiere que el régimen no debería tener motivación para evitar o disminuir su deuda internacional. En este artículo, probamos empíricamente la relación entre el déficit de cuenta corriente y las diferentes variables macroeconómicas mediante el modelo de panel Logit. Por lo tanto, nos centramos en los países MENA durante los años 1980-2017. Construimos un modelo econométrico para analizar la contribución del PIB real, la tasa de desempleo (UR), el índice de precios al consumidor (IPC), la tasa de crecimiento de las exportaciones (EGR), la tasa de crecimiento de las importaciones (IGR), el gasto público (PE) y la tasa de comercio exterior (FTR) sobre el déficit de cuenta corriente (CAD). Establecimos que solo las siguientes variables exógenas: PIB, UR, PE y FTR, tienen un efecto positivo y significativo en el déficit de cuenta corriente. Este resultado puede ayudar a los gobiernos a identificar el mejor momento para las estrategias de inversión y negocios al observar la evolución del desempeño de las industrias de mayor jerarquía temporal.

Palabras clave: déficit por cuenta corriente, modelo Logit de panel, países MENA, variables macroeconómicas.

Clasificación JEL: C13; C23; C51; C52; C55; C58; G17; G18; G28.

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1. Introduction

In last decade, the most discussed issue in financial macroeconomic is the current account (CA) balance. The financial crisis (FC) and the increase in CAD are among the most serious problems in many developing countries. That is because large and obstinate CAD may result in economic and currency crises, growing external debt and drop in international reserves (Eita et al., 2018). Huge CAD sometimes increase concerns about the sustainability of such deficits and raise enquiries about their immoderateness, possible consequence and alterations that may outcome from such disparities.

Numerous nations encountered frequent FC and CAD since 90s, and they have become a great issue for several nations due to the globalization and the openness in the world. The globalization process was one of the main factors that increased the international trade and the mobility of the capital, leading to ample the current account deficits. This broader openness is not only seen as a curse but it is considered as a boon for certain countries as well. According to Eichengreen et al. (1994, p.1), big changes in exchange rates, interest rates and international reserves are all indicators of a crises and they suggest judgment about different macroeconomic variables performance during and after crisis. Furthermore, Kaminsky et al. (1998, p.23) state that monitoring of numerous variables may tend to indicate unusual behaviour that may provide identification of a financial crises prior to its outbreak. Milesi-Ferreti and Razin (1996) define a CA position as unsustainable if the persistence of the present rule stance and/or the private sector performance entails the need of a drastic policy shift or leads to a crisis

However, the MENA countries suffered a lot from this aspect and huge CAD become problematic, especially when they affect negatively the economic growth and the social expansion. Additionally, in the last few decades, there are many emerging countries, especially Next11 countries, which have bumped into the problem of CAD. Calderon et al. (2000) indicate that the CAD in developing countries is moderately persistent, and an upsurge in domestic output growth generates a larger CAD. The MENA area financial issue is frequently connected to the CA imbalances emergence. When capital inflows decreased, the deficit countries started to suffer a deep adjustment process which is accompanied by harsh negative repercussions on the real economy and also on the banking system. Consequently, identifying the deeper causes of the CA imbalances that carried to the crisis has been high on the policy agenda. Therefore, such nations ought to respect the economic policy that aimed at introducing the early warning systems (EWS), which it will support recognizing the financial weaknesses and help several policymakers in checking whether a country may be affecting by a potential crisis.

Until the setting off the crisis, CAD was caught sight of as the result of a welcome picking up process of lower-income countries (Blanchard & Giavazzi, 2002; Campa & Gavilan, 2011; Schmitz & von Hagen, 2011). These scholars' identified two main causes of this crisis, the competitiveness and the fiscal unsteadiness (Arghyrou & Chortareas, 2008; Belke & Dreger, 2013; Schnabl & Wollmershauser, 2013; Zemanek et al., 2010). More latterly, the attention has switched to domestic demand and financial factors as the main operators of CA imbalances.

Many factors represent an important part in affecting a country's CA balance; yet, not all of them are same, but the aspects can be different relying on several contexts. Some are being from macroeconomic fundamentals and other are represented as external factors. It is important to identify the properties of these several factors on the CA balance, and it is compulsory to communicate and to adjust the appropriate policy responses. In addition, almost all Arab countries have no economy diversification and they are still relaying mainly on natural resources, especially the oil exporting (Chekouri, Chibi & Benbouziane, 2017). Such dependence means that those countries are suffering from Dutch Disease Theory (Corden, 1984; Corden & Neary, 1982; Neary & van Wijnbergen, 1986; van Wijnbergen, 1984). The economist magazine coined the term in 1977 to describe the decline of the manufacturing sector in the Netherlands after the discovery of large reserves of natural gas in the North Sea. The Dutch Disease adversely affects economic growth through two main effects: the spending effect and the resource movement effect. Together, these effects result in an appreciation of a country's

real exchange rate, and a fall in the output of the manufacturing sector. The shrinkage of this sector caused by the Dutch Disease can lead to the decline in growth (Sachs & Warner, 1997). Thus, these Arab countries will have an issue with their CA balance when the price of oil and natural gas fall and they cannot depend on other source to cover the deficit.

We shall base on analysing the prospective factors that could increase the probability of CA crises. In this regard, we selected the period of 1980-2017 to observe the properties of recent global crises. We investigated the trajectories of macroeconomic variables in MENA countries to indicate whether the crisis share a common macroeconomic background. For this reason, we examined the contribution of several macroeconomic variables such as real GDP, unemployment rate, consumer price index, export growth rate, import growth rate, public expenditures and foreign trade rate on CAD. And, we defined the main macroeconomic variables driving behind the MENA countries CAD.

The current work is divided into 5 sections. Section 1 demonstrates the introduction of CA problem. Section 2 shows the theoretical framework and main empirical works constructed on two major approaches: the parametric (regression) approach and the non-parametric (signals) approach. Section 3 presents different variables and the specified methodology employed. Section 4 reports the findings from the empirical results analyses. Finally, conclusions are presented in Section 5.

2. Literature review

Various technics have employed to reveal risks to help identify different crisis in the literature (currency, banking, fiscal, monetary...). However, the two most approaches often utilized are the non-parametric (signals) approach and the parametric (regression) approach based on Probit or Logit models. Berti et al. (2012) state that the parametric (regression) approach is constituted of a panel models construing the influences of independent variables on the crisis probability. The endogenous variable can be a binary variable that assumes value of 1 if a crisis outbreaks and 0 otherwise. A non-parametric (signals) approach employs a wholly different method founded on signals instead of resuming the chance of crises in one number between 0 and 1. A variable can be treated sending a warning signal if it goes further than a certain threshold level (Bucevska, 2011). The signals approach was forwarded by Kaminsky, Lizondo and Reinhart (1998). Also, some scholars conducted different in this way (Borio & Lowe, 2002).

Different investigation relied on the parametric regression concerning to different types of crisis. Eichengreen et al. (1996) were amongst the first to employ a Probit model for the prediction of the currency crisis. They established that proven occurrences on fixed exchange rates have a significant influence on the occurrence of currency crises.

Sachs et al. (1997) identified some macroeconomic variables that demonstrate which countries were more sensitive to contagion effects, following the Mexican crisis in 1994. They selected the useful factors that turned out to be meaningful in the prediction of FC using Logit/Probit models.

Lestano et al. (2003) conducted a panel Logit approach for six Asian countries over the period of 1970-2001. They obtained various results for the monetary, banking and debt crisis.

Gerni et al. (2005) investigated with panel Logit method FC in Turkey over the monthly period of 1990-2004. They found that the two crises of 1994 and 2001 experienced in Turkey divulge parallel outcomes, as well as dissimilar consequences for the macroeconomic factors. They found that the interest rates and the industrial production index have a significant sign three months before the crises representative that the sequence of the economy actually begins to deteriorate.

Kahraman et al. (2009) examined the economic crisis in 15 developing countries with the panel data analysis during the period of 1987-2007. They concluded that the CAD and reserve ratios could be pioneering indicators for the prediction of crisis.

Barell et al. (2010) inspected different macroeconomic variables with panel Logit model. They established that CAD has a major positive effect on the probability of a crisis.

Singh (2011) conducted a paper about financial crisis in India between the periods of March 2000 to November 2009. He employed the methodology of ordered Probit model and he indicated that the stock price index and import contribute positively and significantly to the endogenous variable, suggesting high probability of fragility in the banking sector; while the export had a negative and significant influence, but it also rises the chance of fragility in the banking sector.

Bucevska (2011) investigated different indicators that can outbreak of the recent FC in three EU candidate countries (Croatia, Macedonia and Turkey) in the period of 2005 and 2009 by using binomial Logit model. As result, the top three early warning indicators of a financial crisis for these three EU candidate countries are gross external debt relative to export, the domestic loans and the bank deposits in relation to GDP. Additionally, the four highly significant determinants of FC are the overvaluation of the REER, CAD, the fiscal deficit and the capital flight.

Ganioglu (2013) compared the reflections of FC on 26 developed and 24 developing countries during the period 1970-2008 with using panel Logit estimation technique. She evaluated the macroeconomic variables that increase the chance of the FC and she concluded that CAD and the credit expansion together with monetary expansion stimulate the probability of FC.

Comelli (2013) investigated the assessment of currency crisis forecast in emerging market economies with three parametric and non-parametric in 29 EWS during the period 1995-2012. As result, the real GDP growth, the ratio between foreign exchange reserves, short-term external debt, the growth rate in the stock of foreign exchange reserves, and the CA balance have a negative and significant effect related with the probability of a crisis.

Kabadayi and Celik (2015) employed the ordered Probit and Logit in order to study the qualitative macroeconomic variables. They indicated that the CAD, external debts, per capita GDP, real exchange rates, inflations, and savings rates have a huge effect on sovereign ratings.

Cavdar and Aydin (2015a) employed panel logit model to study the different macroeconomic variables and the current account deficit in 16 OECD member countries during the period of 2005-2009. They established that the public expenditure has a positive and significant effect on the current account deficit; however, they found that the consumer price index and unemployment rate contribute negatively and significantly to the current account deficit.

Cavdar and Aydin (2015b) conducted the same study, but they focussed on the period of 2005-2014 in order to concentrate on the pre-crisis and post-crisis period. They confirmed their previous result with dissimilar coefficients, therefore the public expenditure has a positive and significant effect on the current account deficit, but the consumer price index and unemployment rate have a negative and statistically accepted sign on the current account deficit.

Özdamar (2016) concluded with ARDL model that the foreign trade balance and GDP have a positive and significant contribution to the current account balance in Turkey.

Al-Jundi and Guellil (2018) aim to work out the exact pattern of causality between economic growth rate and each of investment categories in the United Arab Emirates. They demonstrate long-term effects of the investment shares in non-oil gross domestic product on economic growth using cointegration and granger causality tests on time series data. The findings indicate unidirectional causality from private investment to non-oil GDP growth rate, from business investment to non-oil GDP growth rate, and from public investment to government investment.

Gumusoglu and Alcin (2019) examined the contribution of the capital flows on current account deficit in Turkey by employing quarterly data for the time period 1998-2015. They used the procedure

of VAR and they found that the capital flows has a significant and positive effect on current account deficit, while the foreign direct investment has negative and insignificant impact.

3. Data and methodology

All data used in this study are annual observations covering the period from 1980 to 2017 and are obtained from two sources. The variables employed in this study are presented in the following table.

Table 1. Variables definition.

Variable	Abbreviation	Definition
Dependent Variable		
Current Account Deficit	CAD	Current Account Deficit / Real GDP
Explanatory Variables		
Real GDP	GDP	Measure of the value of economic output adjusted for price changes.
Consumer Price Index	CPI	A statistical estimate constructed using the prices of a sample of representative items whose prices are collected periodically.
Unemployment Rate	UR	A percentage found by dividing the number of unemployed individuals by all individuals currently in the labor force.
Export Growth Rate	EGR	The amount by which the value of an economy's exports grows over a period of time.
Import Growth Rate	IGR	The amount by which the value of an economy's imports grows over a period of time.
Public Expenditure	PE	The spending made by the government of a country.
Foreign Trade Rate	FTR	Rate of foreign trade between countries.

Source: Own elaboration.

The empirical data corresponding to these variables are collected from the International Financial Statistics Database of International Monetary Fund (IMF), and the World Development Indicators Database of World Bank (WB). Our database includes MENA countries. We classify all countries into one heterogeneous panel only to examine if there are any structural differences.

When studying the connection between Quantitative explanatory variables and Qualitative dependent variables relied on panel data, the choice of the suitable methodology is an important theoretical and empirical issue. Panel Logit/Probit approach is the most appropriate technique to study this type of relationship between the explanatory variables such as: real GDP, UR, CPI, EGR, IGR, PE, FTR and CAD. The empirical strategy employed in this paper can be divided into five principal steps. First, we shall make the data statistical analysis to choose between the two models (Logit or Probit) with normality test. Then, the confirmation whether Logit or Probit model is accepted. Next, we will carry out residual and diagnostic analysis. After, we shall make Expectation-Prediction Evaluation for Binary Specification. Finally, we will proceed to Goodness-of-Fit Evaluation for Binary Specification test.

In this paper, we adopted a model and approach studies by Cavdar and Aydin (2015a, 2015b) Lestano and Kuper (2003) and Demirguç-Kunt and Detragiache (1998). These papers examined the link amongst CAD and some other macroeconomic variables in order to analysis whether this factors have a significant impact on the occurrence of CAD or not, which in turn may increase or decrease the probability of one or more types of FC simultaneously.

We estimated the probability of a CAD using a binary panel logit model, which was developed by Demirguc-Kunt and Detragiache (1998). The dependent variable takes the value of 0 in the case whether there is CAD (crisis) or 1 if there is no crisis in that period. The probability that a crisis appears

at a particular time in a particular country is assumed to be a function of n country specific (i) explanatory variables $X(i, t)$ from 1980 to 2017 (t).

Allison (2009) notes that in the binary panel data (a binary dependent variable), we should use the conditional logit/fixed effects logit models. The fixed effects estimates use only within-individual differences. Long and Freese (2005) show how conditional logit models can be used for alternative specify data.

Breslow and Day (1980), Collett (2003), and Hosmer et al. (2013) provide a biostatistical point of view on conditional logistic regression. Hamerle and Ronning (1995) give a succinct and lucid review of fixed-effects logit. Chamberlain (1980) is a standard reference for this model. Greene (2012) provides a straightforward textbook description of conditional logistic regression from an economist's point of view, as well as a brief description of choice models. These scholars state that the conditional logistic analysis differs from regular logistic regression in that the data are grouped and the likelihood is calculated relative to each group (a conditional likelihood).

Magdalena (2010) displayed that in terms of interpreting the coefficients in binary model and logistic regression, we should use the odds ratio. Also, she defines that the odds ratio is used asymmetrically to infer causality by comparing the occurrence of some outcome (variable X) in the presence of some exposure (variable Y), with the occurrence of the outcome (variable X) in the absence of a particular exposure (absence of variable Y).

Most scholars have said that in most cases, fixed effects make the regression more robust. However, with the conditional fixed-effect logit, we have two main issues; the first one is that there is a multiple positive outcomes within groups encountered, meaning that we have at least 2 matching groups (k_{1i} ; k_{2i}) with $k_{1i} > 1$ for at least one group and there is an error in the data somewhere. The second thing is that we cannot get predicted probabilities, so in this case, we need to estimate the logistic regression to display the classification table and goodness-of-fit.

We did not use the intercept (constant) term, so there is no need of McFadden (1974) coefficient (the pseudo R^2) in the estimation of the logistic regression.

4. Empirical results

4.1. Model diagnostics

We have 13 countries ($N=13$) and 38 years ($T=38$) in this study, we may ignore the cross-sectional dependence (Breusch-Pagan, 1980; Pesaran, 2004), because the cross-section dimension (N) is not large. Thus, there is no evidence of cross-sectional dependence or uncounted for residual dependence. To investigate the normality distribution or not of the series used, we use some normality tests on the set of variables. The results of these tests are presented in the following tables.

Table 2. Descriptive statistics.

	CAD	CPI	EGR	FTR	LNGDP	IGR	LNPE	UR
Mean	0.4716	70.0011	5.1462	77.5252	24.5329	4.6455	22.825	10.282
Median	0	70.8623	3.8070	70.7639	24.4318	3.800	22.707	9.9850
Maximum	1	337.104	337.900	251.138	27.5803	155.500	26.007	31.840
Minimum	0	0.00172	-77.700	13.8000	21.8391	-60.400	19.807	0.6200
Std. Dev.	0.4997	43.7237	23.2704	38.0261	1.2859	17.005	1.230	6.3595
Skewness	0.1135	1.22966	7.4424	1.23484	0.2050	1.9244	0.279	0.4222
Kurtosis	1.0128	8.34073	101.382	5.1104	2.577	20.445	2.591	2.6848
Jarque-Bera	82.336	711.600	203788.2	217.221	7.1434	6569.43	9.847	16.725
Probability	0	0	0	0	0.028	0.	0.007	0.0002

Source: Done on Eviews 10.

Table 3. Univariate normality tests.

	Skewness/Kurtosis joint test Prob of χ^2	Prob of Shapiro-Wilk test	Prob of Shapiro-Francia test
CAD	...	1	1
CPI	0	0	0
EGR	0	0	0
FTR	0	0	0
LNGDP	0.015	0.0005	0.0024
IGR	0	0	0
LNPE	0.0057	0.0001	0.0006
UR	0.0007	0	0

Source: Done on Stata 15.1.

Table 4. Bivariate normality test of Doornik-Hansen.

Pair of variables		χ^2	Prob of χ^2
CAD	LNGDP	599.18	0
	CPI	674.88	0
	UR	448.62	0
	EGR	3675.74	0
	IGR	900.74	0
	LNPE	646.69	0
	FTR	626.83	0
LNGDP	CPI	106.68	0
	UR	44.46	0
	EGR	2952.92	0

	IGR	318.34	0
	LNPE	80.55	0
	FTR	120.81	0
CPI	UR	121.68	0
	EGR	3082.23	0
	IGR	400	0
	LNPE	109.96	0
	FTR	250.20	0
UR	EGR	2993.25	0
	IGR	334.61	0
	LNPE	47.85	0
	FTR	197.75	0
EGR	IGR	3355.55	0
	LNPE	2977.65	0
	FTR	3088.73	0
IGR	LNPE	326.49	0
	FTR	452.79	0
LNPE	FTR	139.35	0

Source: Done on Stata 15.1.

Table 5. The multivariate normality tests.

Tests	χ^2	Prob of χ^2
Mardia with Kurtosis	8038.285	0
Mardia with Skewness	28553.551	0
Henze-Zirkler	7802.311	0
Doornik-Hansen	4041.683	0

Source: Done on Stata 15.1.

Table 6. The generalized linear models estimation.

Variables \ Models	Probit	Logit
C	-4.6925*** (0.0038)	-7.3927*** (0.005)
LNGDP	0.5152*** (0.0028)	0.8371*** (0.0036)
CPI	-0.0002 (0.8782)	-0.0003 (0.8970)
UR	-0.0291** (0.0105)	-0.0492** (0.0103)
EGR	0.0002 (0.9168)	0.0004 (0.9157)

IGR	0.0002 (0.5179)	0.0042 (0.5001)
LNPE	-0.3539** (0.0332)	-0.6003** (0.0352)
FTR	0.0074*** (0.0014)	0.0118*** (0.0019)
LR statistic	42.237***	42.2953 ***
Prob	0	0
Akaike info criterion	1.3975	1.3974
Schwarz criterion	1.4656	1.4654
Hannan-Quinn criterion	1.4242	1.4241
Log likelihood	-337.1946	-337.1675

Source: Done on Eviews 10.

The statistics table (Table 2) shows us that all variables used in this paper followed a non-normality distribution, because according to the Bera test (Bera et al., 1984) test, we rejected the null hypothesis of a normal distribution.

Then, we confirmed this outcome with the joint test of Skewness/Kurtosis which was established by Mardia (1970), Shapiro and Wilk (1965) and Shapiro and Francia (1972), presented in Table 3. The three test show that almost all variables follow a non-normal distribution. Also, Table 4 presents the normality distribution test of Doornick-Hansen (2008), which indicates with this two tests on univariate and multivariate dimension that we cannot accept the null hypothesis of normality distribution. And then we confirmed these results with the multivariate tests of Mardia (1970), Doornick-Hansen and Hansen (2008) and Zirkler (1989) (Table 5).

Therefore, these findings approve that we cannot employ the Probit binary panel model, rather we shall apply the Logit binary panel model. McCullagh and Nelder (1972) describe such qualitative panel model as a class of Generalized Linear Models (GLMs), because it deals with linear regression that allows the non-normal stochastic and non-linear systematic components. Also, GLMs include different linear regression, logistic analysis, and Poisson models. McCullagh (1992) shows the importance to compute the linear Probit/Logit models with the maximum likelihood estimation. Besides, to approve our selection of Logit model, we estimated both Logit/Probit model as showed in table 06, and we found that the Logit model has the minimum coefficient of Akaike (1973), Schwarz (1978) and Hannan-Quinn (1979) criteria, and also it has the greater number of the maximized value of the log likelihood.

Moreover, the binary panel models like Logit/Probit in panel data are considered as standard nonlinear, therefore, we can estimate them with pooled, fixed effects, random effects or population-average model and it is same model as in cross-section case, with adjustment for correlation over time for a given individual. However, we should specify the fixed or the random effects in the binary panel model; thus, we use the Hausman (1978) test to compare with the conditional fixed-effects logistic regression and random-effects logistic regression, the results of the test are presented in Tables 7, 8 and 9.

Table 7. Conditional fixed-effects logistic regression.

	Coefficient	z-statistic	Prob of z	Confidence interval at 95%	
LNGDP	5.0118***	7.31	0	3.6676	6.3559
CPI	-0.0016	-0.42	0.676	-0.0093	0.0060
UR	-0.0674*	-1.67	0.095	-0.1467	0.0117
EGR	0.0016	0.39	0.697	-0.0068	0.0102
IGR	-0.0002	-0.04	0.969	-0.0138	0.0132
LNPE	-5.1810***	-7.41	0	-6.5513	-3.8106
FTR	0.0536***	5.85	0	0.0356	0.0716
Log likelihood		-186.9415			
LR χ^2 (7)		115.53***			
Prob of χ^2		0			
AIC		387.8831			
Bayesian information criterion (BIC)		417.3008			

Source: Done on Stata 15.1.

Table 8. Random-effects logistic regression.

	Coefficient	z-statistic	Prob of z	Confidence interval at 95%	
LNGDP	4.4413***	7.03	0	3.4441	6.1054
CPI	-0.0024	-0.63	0.676	-0.0099	0.0050
UR	-0.0594	-1.52	0.128	-0.1359	0.0170
EGR	0.0016	0.36	0.718	-0.0074	0.0108
IGR	-0.0008	0.12	0.903	-0.0131	0.0148
LNPE	-4.8175***	-6.89	0	-6.1887	-3.4472
FTR	0.0492***	5.50	0	0.0316	0.0667
Intercept	-10.2722*	-1.79	0.073	-21.5162	0.9717
Log likelihood		-239.0504			
Wald χ^2 (7)		60.58***			
Prob of χ^2		0			
AIC		496.1008			
BIC		533.9236			

(.) Denote the probability of the Z-statistic which represent the Wald Chi-square; and *, **, *** mean that we cannot reject the alternative hypothesis and the coefficient estimated is significant at the level of 10%, 5% and 1%.

Source: Done on Stata 15.1.

Table 9. Hausman conditional fixed and random effects testing.

Test summary	χ^2	Prob of χ^2
Coefficient	72.79***	0

***, indicates that we reject the null hypothesis; rather we accept the alternative hypothesis at the level of 1%, so the panel model should be estimated with fixed-effect.

Source: Done on Stata 15.1.

We established that we cannot reject the alternative hypothesis and we accept the conditional fixed-effects logistic regression in this study. Also, we confirmed this findings with the log likelihood coefficient and both (AIC) and Bayesian information criterion (BIC) developed by Schwarz (1978) and Akaike (1977).

After some of iterations done with the conditional fixed-effects logistic regression (all possible regressions, and after removing non-significant variables), we find that the best significant explanatory variables used in the model are presented in Table 10.

Table 10. Conditional fixed-effects logistic regression.

	Coefficient	z-statistic	Prob of z	Confidence interval at 95%	
LNGDP	4.9359***	7.41	0	3.6294	6.2423
UR	-0.0695*	-1.73	0.083	-0.1482	0.0091
LNPE	-5.1747***	-7.43	0	-6.5401	-3.8094
FTR	0.053***	6.14	0	0.0361	0.06995
Log likelihood	-187.0993				
LR χ^2 (7)	115.22***				
Prob of χ^2	0				
AIC	382.1987				
BIC	399.0088				

Source: Done on Stata 15.1.

Having established model diagnostics, in the next step we proceed to the model interpretation.

4.2. Model interpretation

4.2.1. The logistic regression with odds ratio

After confirmation of the fixed effects specificity in the Logit panel model, must be followed by the estimation this relationship. The results of Logistic regression with odds ratio are presented in Table 11.

The likelihood ratio chi-square (4) of 26.81 with a p-value of 0 indicates that we reject the null hypothesis; rather we accept the alternative hypothesis, so the overall model is well specified and it can be employed in forecasting studies.

Table 11. Logistic regression with odds ratio.

	Odds Ratio	z-statistic	Prob of z	Confidence interval at 95%	
LNGDP	1.6470**	2.06	0.04	1.0241	2.6489
UR	0.9433***	-3.67	0	0.9144	0.9732
LNPE	0.5864**	-2.04	0.042	0.3507	0.9804
FTR	1.0055**	2.16	0.031	1.0005	1.0107
Log likelihood		-327.4621			
Wald χ^2 (7)		26.81***			
Prob of χ^2		0			
AIC		662.9242			
BIC		679.7343			

Source: Done on Stata 15.1.

We found that the iteration log, indicating how quickly the model converged. The log likelihood of -327.4621 can be employed in comparisons of other models or nested models.

McFadden R^2 is the likelihood ratio index and it is an analog to the R^2 reported in linear regression models, but we do not use the intercept term, so there is no need of pseudo R^2 .

Z-statistic is the rate significance of estimated coefficients; it does not follow the student distribution, but a logistic distribution indicated by Wald Chi-square.

In the reading result, we shall transform the coefficients and interpret them as odds-ratio. The odds ratio for LNGDP is 1.647 and statistically accepted at the level of 5%, suggesting that these MENA countries if they decided to increase their economic growth, their odds of being in CAD would be multiplied by 1.647. Therefore, such country should make a wise decision and strategic plan to earn more stable financial situation. The odds ratio for UR is 0.9433 and significantly at the level of 1%, showing that the unemployment people in these nations increase the CAD by 0.9433. The odds ratio for public expenditure is 0.5864 and statistically accepted at the level of 5%, so it multiplies the CAD by 0.5864, indicating that the government spending is not used in efficient way.

The odds ratio for foreign trade rate is 1.0055 and significantly at the level of 5%, so it participates to surge the CAD by 1.0055, confirming the Harberger-Laursen-Metzler (HLM) hypothesis. This theory is proposed by Harberger (1950) and Laursen and Metzler (1950) which indicates that the terms of FTR deterioration will cause a decrease in savings and a negative influence on the CA. This is due to the decrease in real income, which will cause an increase in real expenditure (in order to maintain a standard of living). In another word, the adverse transitory terms of trade shocks produce a decline in current income that is greater than that in permanent income. Hence, a decline in savings follows and, thus, deterioration in the CA position ensues.

We cannot use the predicted probabilities to help us to understand the model, because there is no binary variable, except the dependent variable.

4.2.2. The predicted probabilities analysis

Table 12 shows results of calculating predicted probabilities, this step is to help a better understanding the model.

Table 12. The predicted probabilities.

LNGDP	Margin	z-stat	Prob	CI at 95%		UR	Margin	z-stat	Prob	CI at 95%	
21	0.1655*	1.88	0.06	-0.0067	0.3378	0.5	0.6119***	14.59	0	0.5297	0.6941
22	0.2342***	2.91	0.004	0.0765	0.3919	5	0.5492***	18.83	0	0.4920	0.6063
23	0.3190***	5.35	0	0.2021	0.4360	9.5	0.4848***	21.42	0	0.4404	0.5292
24	0.4169***	14.15	0	0.3592	0.4747	14	0.4209***	14.5	0	0.3640	0.4778
25	0.5220***	18.81	0	0.4676	0.5764	18.5	0.3596***	8.75	0	0.2791	0.4401
26	0.6262***	10.06	0	0.5042	0.7483	23	0.3025***	5.79	0	0.2002	0.4048
27	0.7217***	8.00	0	0.5450	0.8985	28.5	0.2508***	4.17	0	0.1329	0.3688
28	0.8024***	7.78	0	0.6001	1.0046	32	0.2054***	3.19	0	0.0791	0.3316
LNPE	Margin	z-stat	Prob	CI at 95%		FTR	Margin	z-stat	Prob	CI at 95%	
20	0.7808***	7.45	0	0.5755	0.9861	10	0.3867***	9.02	0	0.3027	0.4708
21	0.6855***	8.24	0	0.5225	0.8485	45	0.4322***	15.41	0	0.3772	0.4872
22	0.5735***	12.88	0	0.4862	0.6607	80	0.4787***	21.35	0	0.4348	0.5227
23	0.4544***	19.53	0	0.4087	0.5	115	0.5256***	15.89	0	0.4608	0.5904
24	0.3401***	5.79	0	0.2249	0.4552	150	0.5720***	11.46	0	0.4741	0.6698
25	0.2408***	2.82	0	0.7317	0.4084	185	0.6171***	9.23	0	0.4860	0.7482
26	0.1621***	1.73	0	-0.0217	0.3461	220	0.6603***	8.07	0	0.4999	0.8208
27	0.1047***	1.20	0	-0.0658	0.2753	255	0.7011***	7.46	0	0.5168	0.8853

Source: Done on Stata 15.1.

We generated the predicted values of the exogenous variables with different minimum, maximum value, and diverse level of the increments. Therefore, the predicted probabilities table show that the mean predicted probability (margin) of being almost (significant at the level of 10%) accepted is only 0.1655 if one's LNGDP value is 21 approximately 1318815734 US \$ and increases to 0.8024 if one's LNGDP value is 28 approximately 1446257064291.48 US \$. The mean predicted probability of being accepted is only 0.6119 if one's UR value is 0.5 and decreases to 0.2054 if one's UR value is 32. The mean predicted probability of being accepted is only 0.7808 if one's LNPE value is 20 approximately 485165195.4 US \$ and cuts to 0.1047 if one's LNPE value is 27 approximately 532048240601.8 US \$. The mean predicted probability of being accepted is only 0.3867 if one's FTR value is 10 and rises to 0.7011 if one's FTR value is 255.

4.2.3. The classification table examination

The following table allows apprehending the forecasting qualities of the model on the whole sample. In the classification table, cases with probabilities ≥ 0.5 are predicted as having the occurrence; other cases are predicted as not having the occurrence. Preferably, in most study we would like to have and to demonstrate that we have two groups with very different estimated probabilities. Our outcomes showed that 118 of the 233 observations that have no CAD, therefore, such 118 cases will avoid the crises. The model is perfectly predicted at (50.64%). Likewise, our findings confirm that 189 of the 261 observations remain in CAD, thus these 189 cases will suffer from the crises. The model is correctly predicted at (72.41%). However, 115 cases from 233 are classified as an observation with no CAD, but they will probably suffer from crises in the near future. The model is appropriately predicted at (49.36%). Similarly, 72 of 261 observations are considered as data that have the CAD, but they will probably escape from the crises in the near future. The model is suitably predicted at (27.59%).

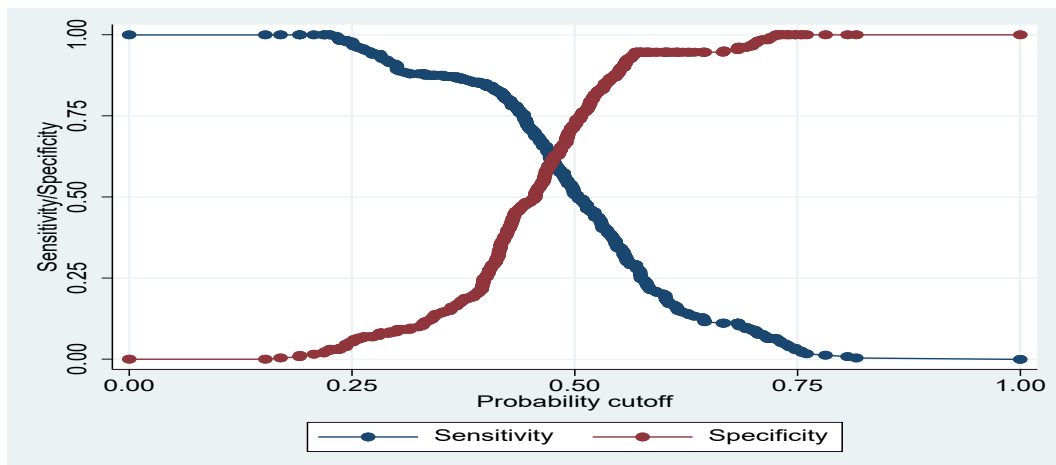
Table 13. The classification table.

	True		
Classified	D	~D	Total
+	118	72	190
-	115	189	304
Total	233	261	494
Classified + if predicted $\Pr(D) \geq 0.5$			
True D defined as CAD != 0			
Sensitivity	$\Pr(+ D)$		50.64%
Specificity	$\Pr(- \sim D)$		72.41%
Positive predictive value	$\Pr(D +)$		62.11%
Negative predictive value	$\Pr(\sim D -)$		62.17%
False + rate for true ~D	$\Pr(+ \sim D)$		27.59%
False - rate for true D	$\Pr(- D)$		49.36%
False + rate for classified +	$\Pr(\sim D +)$		37.89%
False - rate for classified -	$\Pr(D -)$		37.83%
Correctly classified			62.15%

Source: Done on Stata 15.1.

In general, the correctly classified table showed that 62.15% of the model is suitable for prediction. We can also see in the Figure 1, that there is a concordance outcome with the previous findings.

Figure 1. Sensitivity and specificity vs probability cutoff.



Source: Done on Stata 15.1.

4.3. Goodness-of-fit

As a last step, we perform the Goodness-of-fit test to see if the sample data represents the data that expect to find in the actual population. The results are expressed in Table 14.

Table 14. Goodness-of-fit test.

Test	Pearson χ^2 (494)		Prob
Pearson	496.37		0.4615
Test	Hosmer-Lemeshow χ^2 (3)	Number of group	Prob
Hosmer-Lemeshow	4.18	3	0.2425

Source: Done on Stata 15.1.

The two tests denote that the whole model is well specified (we can't reject the null hypothesis; rather we accept it at the level of 5%) and is good fitted, so we can confirm that the observed and expected cell frequencies are generally in good agreement. However, after fitting the logistic regression model taking into account the previous result, the replaced F-adjusted mean residual goodness-of-fit test, which is the Wald test determined in the Table 11 suggest that there is no evidence of lack of fit.

We declare that the number of group is 3, because of there is 3 main classified economy country speciation; such as the first group is composed of Algeria, Egypt, and Saudi Arabia... These countries rely on the fossil-fuel exportation. The second group include Tunisia, Morocco, and Turkey, which their main sector is the tourism, while the 3rd group comprise Syrian, and Iran. These two countries suffer from civil war and economic restriction.

5. Conclusions

The adoption of CA policy as a scope for monetary policy in MENA countries will represent one of the most important subjects for Central Banks while conducting their economic policies since the introduction of floating exchange rates at the beginning of 1970s. The sustainability of CAD is a query of concern for almost all governments since CAD becomes more acute and unsustainable and creates volatility and eventually leads to financial distress or FC.

These results demonstrate the crucial necessity for designing integrated strategic plans for the CA imbalances, which may lead to FC. For example, when we focus on the forecasting probabilities, we will predict that a rise by one unit in LNGDP in the minimum value will surge the CAD by 0.1655, which is approximately 1318815734 US \$, while an increase by one unit in LNGDP in the maximum value, will upsurge the CAD by 0.8024 which represent around 1446257064291.48 US \$. In addition, these results may help the governments to establish priorities regarding to the assignment of the resources for national strategies to avoid FC. Different variables may be included and a wider time span can also be studied to analyse the CAD problem of countries in the aftermath of the recent global FC.

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