



An Early Warning System for Currency Crisis: A Comparative Study for the Case of Jordan and Egypt

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ABSTRACT

The paper investigates the differences between number of indicators used for an early warning system to explain any potential currency crisis for the case of Jordan and Egypt. The comparison is based on estimating various leading indicators that help in predicting the currency crises in the countries under investigation. A market pressure index was constructed and employed in a multinomial Logit model, using monthly data for Jordan and Egypt covering the period 1980-2015. The empirical results, show that real exchange rate (RER), money supply-reserves ratio (M2R), growth rate of domestic credit (ΔDC), Central Bank foreign assets to liabilities ratio (AL), and growth of exports play a significant role in explain the currency crises for both Jordan and Egypt economies. However, the money supply-reserves ratio is the one of the most significant indicators in predicting currency crisis for Jordan, while the RER is found for the case of Egypt.

Keywords: Early Warning Systems, Currency Crisis, Logit Model, Jordan, Egypt

JEL Classifications: F31, F47, C53

1. INTRODUCTION

Over the last two decades, many countries have witnessed financial instability and were affected by financial crises. These crises embarrassed policy makers and took them somewhat by surprise and tended to lead to huge losses in income. These events have been the focus of research attention in an attempt to develop methods that could assist explaining and understanding the cause of crises, and to identify indicators that could predict them.

It difficult to find a widely accepted definition of a currency crisis, which is normally considered as part of a financial crisis. Kaminsky et al. (1998), for instance, define currency crises as when a weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in exchange reserves exceeds its mean by more than three standard deviations (SDs). Frankel and Rose (1996) define a currency crisis as a nominal depreciation of a currency of at least 25% but it is also defined at least 10% increase in the rate of depreciation. Currency crises are usually defined as large depreciations of the nominal exchange rate and/or extensive losses of foreign exchange reserves over a 24 month forecast horizon. Specifically, a currency crisis is

said to occur when the exchange market pressure (MP) index – a weighted average of 1-month changes in the exchange rate and foreign exchange reserves – is two or three (country-specific) SDs above its (country-specific) mean¹.

In general a currency crisis can be defined as a situation when the participants in an exchange market come to recognise that a pegged exchange rate is about to fail, causing speculation against the peg that hastens the failure and forces a devaluation or appreciation.

Jordan is a small open economy, with a fixed exchange rate, and was hit by a currency crisis in 1988-1989. Prior to the crisis, the economy exhibited several imbalances caused by a huge deficit of the trade balance, a lack of foreign exchange reserves, which arose as a result of the decrease in workers' remittances and foreign grants, banking problems, a recession and a decrease in the growth rate. Most of these challenges were mainly resulting from structural reforms. The monetary authority then wanted to control the negative consequences of these challenges by the Jordanian dinar in 1989.

¹ Bussiere and Marcel (2002), and Comelli (2014).

Egypt's economy has also experienced different structural changes due to the several economic reforms that started from the beginning of 1990s. Most of these economic reforms targeted financing issues through both the IMF and The World Bank Organizations by following contractionary fiscal policies to curb fiscal deficit and inflation. In 1990s, the central bank of Egypt started implementing a pegged regime for the Egyptian currency to the dollar, which functioned for a time, but there was a currency squeeze beginning as early as 1998, brought on by over expenditure on large infrastructure projects during a time of diminishing the revenues of tourism sector at that time. This has caused the Egyptian pound to be devaluated and lost about 32% of its value in 2001.

This research aims to employ quantitative method to explain the currency crises in both economies, Jordan and Egypt, to evaluate various indicators that can formulate an early warning system (EWS) for currency crisis. The main methodology adopted in this research is based on the multinomial Logit estimation for the period 1980-2015 for both Jordanian and Egyptian data. This paper attempts to identify a number of leading indicators that can help our understanding of crises and compare the results for both economies as Jordan and Egypt have experienced currency crisis during the last decades.

The rest of the paper is organized as follows: Section 2 reviews the previous empirical literature. Section 3 presents the data and methodology used in the analysis. Section 4 discusses the estimation results and provide the comparison between Jordan and Egypt. Section 5 concludes.

2. LITERATURE REVIEW

In the past few decades, there were a significant number of studies on developing EWSs for currency crises, concentrating on their reliability in anticipating upcoming crises (Jeanne, 2000). The EWS were studied intensively due to their high importance in predicting banking and currency crises before occurring. Therefore, these predictions give policy makers the opportunity of taking counter actions proactively. Not to mention that both developed and emerging countries suffered from these crises, which also increases the importance of such studies. As we will see in the upcoming review, these methods include both parametric and non-parametric criterion such as qualitative indicators, signals extraction, limited independent regression and generation models. Non-parametric criteria, signals approach, which mainly monitors some key indicators which tend to perform at the beginning of the crisis, while the econometric modeling, Logit-Probit and Markov switching models, in such approaches researchers estimate a quantitative model, reflecting the probability of a currency crisis on a group of economic indicators.

One of the first approaches to develop an EWS to anticipate crises was firstly developed by Kaminsky and Reinhart (1996)²,

² However, Diebold and Rudebusch (1989) used formal probability-assessment scoring rules to assess the composite index of leading indicators in order to predict financial crises. Their study is based on using the Bayesian sequential probability recursion on the leading index generated the composite index.

and Kaminsky et al. (1998) considered vulnerability indicators and convert them into binary signals. They defined a currency crisis as a weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in foreign exchange reserves when they exceed the mean by more than 1.1 or 3 SDs. They found that the exchange rate changes were the main indicator in any EWS. In Bruggemann and Linne (2002), a currency crisis is defined as a 20% depreciation against the US dollar within 10 trading days, and they found that, in addition to the overvaluation of the exchange rate, weak exports, falling foreign exchange reserves, and banking sector indicators were useful in assessing crisis vulnerabilities (Obstfeld, 1996).

Frankel and Rose (1996) used a probit model to analyze a currency crisis, employing data for 105 countries. They defined a currency crisis as a nominal depreciation of the currency by at least 25% or at least a 10% increase in the rate of depreciation. They found that currency crises will occur when output decreases, domestic credit growth increases, foreign interest rates rise and when the exchange rate is overvalued. Bussiere and Marcel (2002), Lestano and Kuper (2003), and Feridun (2008) developed a Logit model for 32 emerging countries, six Asian countries and Turkey, respectively. They found that many variables play a significant role in predicting a currency crisis, such as the ratio of M2 to foreign reserves, the domestic real interest rate, and the use of contagion variables.

Berg and Pattillo (1999) found out using the probit model that there is a proof on the nonlinearity between predictive variables and the banking crises probability. Their study did not extend to the currency crises prediction due to the limitations of the probit model in this type of crises. However, the result that Berg and Pattillo of predicting banking crises using the probit model was different from the signal approach proposed by Kaminsky et al. (1998).

Vlaar (1999) presented on his work a new approach of EWS for currency crises and exchange rate distress. Where it allowed anticipating the crisis and its timing relying on the use of a crises index derived from the average of exchange rate variations and reserves losses. The drawback of this paper is that it remained untested with regards the financial distress caused by banking sector problems, which affects the same macroeconomic variables, used in this research.

Glick and Hutchison (2005) and Glick et al. (2006) concentrated on the effect of capital controls on exchange rate stability and currency crises. They could not find evidence on the fact that capital controls are effective in protecting countries from currency crises even when taking into consideration that a country with relative weak economic fundamentals is more likely to enforce capital controls.

El-Shazly (2006) investigate the development of an EWS of currency crisis for the case of Egypt. The study employed qualitative response models within a signals framework in order to monitor the behavior of key economic indicators concentrating on the depth of economic problems in such variables. The empirical results show that the extreme value model captures the turbulence in the foreign exchange market and the onset of crises. Another study is by Abumustafa (2006) attempted

to provide empirical evidence on the causes prior to the financial crises happened in selective MENAT countries which includes Jordan, Egypt, and Turkey.

Boinet et al. (2005) and Cipollini et al. (2008) studied currency crises in Argentina and the European monetary system, respectively; using Markov switching models to investigate whether first or second generation can explain the crises in these countries.

Al-Assaf et al. (2013) performed one of the recent studies on the case study of Jordan. Their paper employed the logit model and used various variables that reflect the monetary factors that affect the Jordanian currency and estimating different thresholds. The empirical results show that real exchange rate (RER), the ratio of money supply to total reserves, and the growth in domestic credit variables had a crucial effect in predicting and comprehending currency crises.

A recent paper by Jdaitawi et al. (2014) investigated the leading indicators associated with the start of currency crisis in Jordan between 1989 and 1991. The research employed both signaling and Logit method to estimate the impact of the key factors on currency crisis. The empirical results suggest that sharp decline in international reserves, decline in the trade balance, and increase the broad money supply (M2). It is also found that the increase in the exchange rate of the Jordanian Dinar raises the probability of currency crisis in Jordan.

On the other hand, others employed different techniques, for example, Sachs et al. (1996) used cross-sectional analysis, for about 20 countries at 1995, depending on an equation for the index of the crisis. This index is a function of a number of indicators, including the RER, lending boom, and weak fundamentals. They found that some degree of previous misbehavior was a necessary condition for a crisis. The misalignment takes the form of an overvalued RER and a recent lending boom, coupled with low reserves relative to the Central Bank's short-term commitments. Aziz et al. (2000) use a comparison approach of pre- and post-crisis behavior of indicators, including measures of overheating, external imbalances, unemployment rate, short-term capital inflows, and the world interest rate. They found that overvaluation, terms of trade, inflation, domestic credit growth, M2-reserves ratio, world interest rate, and the current account are all useful indicators.

It is clearly noticed that different econometric techniques are employed to determine the most important indicators that can anticipate currency crises. However, a number of leading indicators were suggested by the empirical studies. Most of these key variables are macroeconomic variables, such as the RER, the money supply-reserves ratio, the growth rate of domestic credit, the current account balance and the debt-gross domestic product ratio. Other indicators included a measuring of banking sector fragility and financial sector weaknesses, such as banks' reserve-assets ratio, banks' loans-deposits ratio and portfolio-capital flows ratio. There is no specific study conduct a comparison between these indicators for two-country cases. Therefore, this paper comes to fill some gab in the literature by trying to compare between these indicators for both Jordan and Egypt.

3. DATA AND MODEL SPECIFICATION

3.1. Data

In this section, the main macroeconomic indicators and their effects on MP are investigated for the case of Jordan and Egypt. The data used covering the period January 1980 to December 2015 for both countries on a monthly basis. The objective is to estimate a model to capture the key factors that affect the MP index for the Jordanian and Egyptian exchange markets. It employs several variables in the empirical model, namely MP on the exchange rate, MP_t : The real exchange rate, RER_t : The ratio of broad money supply (M2) to reserves, $M2R_t$: The growth rate of domestic credit; ΔDC_t : The ratio of Central Bank's foreign assets to foreign liabilities; AL_t : The growth rate of exports, ΔX_t : The growth rate of imports, ΔM_t : And the output growth rate approximated by industrial production (as output data are available annually or quarterly only), ΔIP_t . All data are assembled from the International Monetary Fund's International Financial Statistics, and the Central Banks of Jordan and Egypt.

3.1.1. MP on the exchange rate

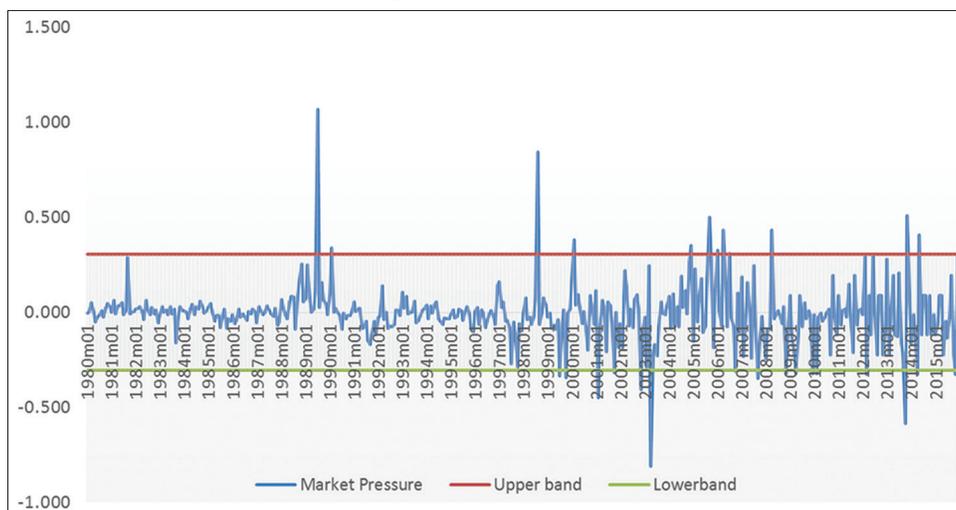
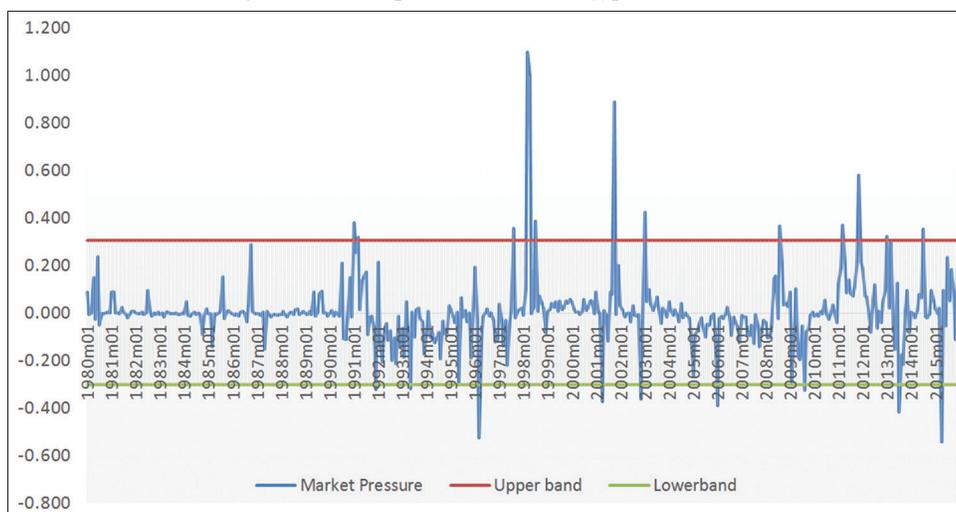
Central Banks are usually control the foreign exchange market through either reducing the level of foreign exchange reserves held by these banks, or increasing the interest rates aiming to avoid exchange rate fluctuations. It is therefore known that capturing the MP on the exchange market is based on using an index of speculative pressure that incorporates the measures of speculative attack on the exchange rate is labeled as MP with a currency crisis defined as when this index exceeds a certain threshold. Following Eichengreen et al. (1995), the MP index can be calculated as:

$$MP_{it} = \alpha \Delta ex_{it} - \beta \Delta r_{it} + \gamma \Delta dr_{it} \quad (1)$$

Where, Δ denotes monthly percentage change; ex_{it} is the nominal exchange rates (Jordanian dinar: US\$) and (Egyptian pounds: US\$); r_{it} is the Central Bank's foreign exchange reserves; dr_{it} is the discount rate; the parameters α , β , and γ are weighted average calculated as: $1/\sigma_i$, where σ_i is the SD of the full sample for the exchange rate, reserves, and interest rate, respectively.

A positive value of MP indicates increased pressure in the foreign exchange market that can be caused by any combination of a devaluation of the nominal exchange rate, a loss of the reserves, or an increase in the interest rate. While a negative value of MP can be caused by an appreciation, an increase of reserves, or a decrease in the interest rate. Figures 1 and 2 show the plot of MP for both Jordan and Egypt, respectively. Therefore, a currency crisis will occur if this value of MP exceeds a particular threshold. The threshold³ is a certain value set as the average of $MP \pm SD$ of MP. This generates two bounds for the MP index; the upper bound represents the depreciation case and the lower bound denotes appreciation. In order to make a comparison between averages the threshold is calculated using 1.5 SDs in each case.

3 The choice of the standard deviation to calculate a threshold value is arbitrary, according to the literature it lays between 1 and 3 standard deviations, it is therefore, calculated using the average (1.5) in this study.

Figure 1: Market pressure index for Jordan (1980-2015)**Figure 2:** Market pressure index for Egypt (1980-2015)

In this paper, the MP index is measured as a weighted average of the Jordanian dinar/Egyptian pound depreciation (appreciation) against the US dollar, change in reserves, and change of discount rate. These weights are country specific, and calculated as inversely related SD of each series over the period January 1980 to December 2015 for each market separately.

Based on the figures presented previously, a number of anticipated episodes can be captured using the estimated MP index for both Jordan and Egypt markets. It is clear that the index successfully captures the late 1980s crisis. However, the fluctuations in the index prior to 1990 were due to changes in the exchange rate and the interest rate, while thereafter it is caused by changes in interest rate and changes in reserves, as the exchange rate is pegged with US dollar. For the case of Egypt, it is also noticed that the estimated MP index successfully captures the crises happened in Egyptian economy during the years 1998 and 2001.

3.1.2. Factors affecting currency crises

Several variables are used to build an EWS for currency crises. One of the most important factor that provide an indication for the

predicted currency crises is the real exchange rate overvaluation, RER. It is measured by the difference between REX and REX^e (Feridun, 2008), where REX is the real exchange rate calculated by multiplying the official exchange rate, e , (JD: \$US) by the US wholesale price index, P^* , and divided by the consumer price index of Jordan, P , as:

$$REX = e \left(\frac{P^*}{P} \right), \text{ and } REX^e \text{ is the deterministic trend of the real exchange rate.}$$

RER is a measure of international competitiveness and is a proxy for over (under) valuation. We expect the RER will affect MP negatively, where an overvalued real exchange rate leads to a high probability of a currency crisis.

The second factor is the ratio of the money supply (M2) to total reserves minus gold in the Central Bank, M2R, measures the available foreign exchange reserves. This indicator captures the extent to which the liabilities of the banking system are backed by foreign currencies. In the event of a currency crisis individuals

may rush to convert their domestic currency deposits into foreign currency and so this ratio captures the ability of the Central Bank to meet their demand (Edison, 2003). We expect to find a positive relation between M2R and MP.

In addition, domestic credit growth rate, ΔDC , is also used to formulate an EWS. It is calculated by taking the change in the natural logarithm of domestic credit. An increase in domestic credit growth may serve as an indicator of the fragility of the banking system. We expect that ΔDC will have a positive effect on MP.

The ratio of a Central Bank's foreign assets to foreign liabilities, AL , is an indicator of banking fragility. Therefore, any decrease in this ratio reflects a decrease in a Central Bank's ability to manage its foreign commitments. We expect to find a negative relation between AL and MP.

The growth rate of exports and imports, ΔX and ΔM , are calculated by taking the change in the natural logarithm of exports and imports. Declining export growth implies that there is a loss in competitiveness in the international goods market. That decline may be caused by an overvalued domestic currency; also it indicates the country's ability to earn foreign currency to finance an existing current account deficit. On the other hand, excessive import growth may show that the exchange rate is overvalued, which could lead to a loss in competitiveness and a worsening in the current account. We expect to find a negative relationship between ΔX and MP, and a positive relationship between ΔM and MP.

The growth rate of industrial production index, ΔIP , is used as a proxy of the output growth, where a recession often precedes financial crises. We expect to find a negative relationship between ΔIP and MP.

The previous discussion is related to the effect of each factor on MP in the case of depreciation; however, the expected signs are reversed in the case of appreciation.

3.2. Methodology and Model Specification

The aim of this paper is to capture the key indicators responsible for explaining a currency crisis. A group of economic indicators suggested by the literature is employed to model the probability of a currency crisis using the index of MP. The suggested model can be formed as follows:

$$MP_t = \beta_0 + \beta_1 RER_t + \beta_2 M2R_t + \beta_3 \Delta DC_t + \beta_4 AL_t + \beta_5 \Delta X_t + \beta_6 \Delta M_t + \beta_7 \Delta IP_t + \varepsilon_t \quad (2)$$

The main methodology adopted in this paper is based on the multinomial Logit model, in view of the fact that the MP can be converted to three outcomes; -1 , 0 and 1 according to the definition of the currency crisis followed in this paper by taking appreciation in account.

In line with Feridun (2008) the dependent variable (MP) can be converted to a binary representation as:

$$Y=f(x) = \begin{cases} 1, & MP > \text{AVG}(MP) + 2SD(MP) \\ -1, & MP < \text{AVG}(MP) - 2SD(MP) \\ 0, & \text{otherwise} \end{cases} \quad (3)$$

i.e., $f(x)$ has three outcomes. When MP exceeds its average plus two SD, ($Y = 1$), the crisis happened because of a depreciation. When MP is less than its average minus two SD, ($Y = -1$), the crisis happened because of an appreciation. When the MP index lies between the two bounds ($Y = 0$), then the currency is not facing pressure to change. In such a situation, a linear regression model cannot be used because it would lead to an egregious regression. Instead, a non-linear probability model will be employed using a multinomial Logit model, giving a S-shaped logistic function to constrain the probabilities into an interval of $(-1, 1)$. The econometric regression is run on a number of variables to explain a dichotomous indicator equal to 1 or -1 if a crisis occurs within the specified time period, or equal to zero otherwise,

$$P(Y = 1) = \Omega(\alpha_1 + \beta_1 X) = \frac{e^{(\alpha_1 + \beta_1 X)}}{1 + e^{(\alpha_1 + \beta_1 X)}} \quad (4)$$

$$P(Y = -1) = \Omega(\alpha_2 + \beta_2 X) = \frac{e^{(\alpha_2 + \beta_2 X)}}{1 + e^{(\alpha_2 + \beta_2 X)}} \quad (5)$$

Where Ω is the logistic cumulative distribution function, and β_i represents a vector of the coefficients of the explanatory variables. Positive values of these coefficients mean an increase in the probability of crises and negative ones imply the opposite.

In order to interpret the coefficients, the marginal effect (ME) for each coefficient is estimated, where the coefficients themselves represent probabilities. The ME can be expressed as:

$$\frac{dy}{dx} = \beta_i \Omega'(\alpha_i + \beta_i X) \quad (6)$$

Using this model resolves some disadvantages associated with other approaches. Here the results appear easier to interpret, because they are the probabilities of a crisis. Furthermore, statistical tests are immediately available, and the effect of all explanatory variables can be captured simultaneously.

4. EMPIRICAL RESULTS

4.1. Unit Root Test

We first test the variables for unit root, it is clearly seen confirmed that all variables were $I(0)$. Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and unit root tests confirmed the stationary hypothesis for the level of each series (Dickey, 1979, 1981). Table 1 summarizes unit root tests results for both Jordan and Egypt variables.

For the level variables, under ADF and PP the null hypothesis of a unit root is rejected at the 5% significance level, except for RER for Jordan, which can be rejected at the 10% significance level.

4.2. Multinomial Logit Model Results

Estimating the probability of currency crises requires converting MP values to three values, -1 , 0 , and 1 , to represent the dependent variable in the multinomial Logit model. The conversion procedure

depends on Table 2. The MP index is constructed following the average of the SD used in calculating the threshold, where MP used 1.5 SD.

Tables 3 and 4 show the results of the multinomial Logit models for the case of Jordan and Egypt, respectively, which investigate the probability of the currency crises employing the explanatory variables mentioned above. The column labeled ($Y = -1$) represents results of the appreciation of MP; i.e., when MP less than its average minus the SD. The column labeled ($Y = 1$), on the other hand, shows the results of the depreciation of MP; i.e., when MP exceeds its average plus the SD. The third and the fifth columns report the ME for each output.

For the case of Jordan, the empirical results, in Table 4, show that there is strong evidence that the money supply to reserves ratio

Table 1: Unit root tests results (intercept included)

Variables	Jordan		Egypt	
	ADF	PP	ADF	PP
MP	-8.429*	-14.473*	-5.148*	-10.543**
RER	-3.523**	-2.443***	-3.547*	-3.865**
M2R	-4.218*	-5.964*	-2.941**	-4.751*
Δ DC	-10.423*	-19.647*	-10.730*	-19.752*
AL	-3.652*	-4.771*	-2.871**	-3.246*
Δ X	-12.412*	-47.548*	-9.463**	-42.883*
Δ M	-4.379*	-49.132*	-5.821*	-53.763*
Δ IP	-5.127*	-29.766*	-4.150*	-31.9511*

For ADF Schwarz information criterion used to select the lag length and the maximum number of lags was set to be 15. ADF and PP critical values: 1% - 3.447, 5% - 2.869. *** and ** indicates significant at 1%, 5% and 10%, respectively. ADF: Augmented Dickey-Fuller, PP: Phillips-Perron, MP: Market pressure, RER: Real exchange rate

(M2R) and domestic credit growth (Δ DC) and the ratio of a Central Bank's foreign assets to foreign liabilities (AL) play a significant role in the appreciation case. However, the RER, foreign assets to liabilities ratio (AL) and growth rate of exports (Δ X) play a significant role in depreciation case. The ME is varying. The impact of the money supply to reserves ratio (M2R) has the greatest ME, in the case of appreciation being -94.7% for an appreciation; and 3.4% for a depreciation. In addition, the growth in domestic credit (Δ DC) has about 74.4% significant ME for the appreciation case. The results show that the probability of a crisis is decreased by an increase of RER, growth in exports. The estimated results also show that most of the signs of estimated coefficients has the anticipated signs, which is consistent with the theory.

On the other hand, the estimated results for the case of Egypt produce quite different picture. The empirical results, shown in Table 4, indicate that in the appreciation case, Δ DC, AL, Δ M, and Δ IP are the only significant estimated coefficients in the model with correct signs of the influence of the explanatory variables. The MEs of these probabilities are -63.2%, -34.7%, -7.2%, 23%, respectively. In contrast, RER, M2R, and Δ X variables play a significant role in the depreciation case. The greatest ME among these variables is the RER with about -117%. The results show that, for the case of Egypt, the RER is the most important factor that can be employed to predict the probability of crisis. The results also show that growth in export in Egypt play a very significant effect in predicting the currency crisis, where the probability of a crisis is decreased by an increase of exports growth. The effect is significant and has a large impact of about 60.7% for the depreciation case. This finding confirms the fact

Table 2: Crisis episodes captured by the estimated MP (1980-2015)

Crisis episodes dates	Jordan		Egypt	
	Threshold		Threshold	
	+1.5 SD	-1.5 SD	+1.5 SD	-1.5 SD
MP	09/81, 11/88, 02/89,	12/93, 07/99, 10/99, 01/00,	03/80, 06/82, 04/85, 11/86, 06/90,	04/81, 08/82, 11/84, 02/85,
Date as: (M/Y)	07/89, 02/90, 08/91,	09/00, 02/01, 10/01, 11/02,	12/90, 01/92, 03/95, 04/97, 02/98,	02/87, 08/90, 04/91, 12/91,
	08/98, 05/05, 09/05,	04/03, 05/03, 06/03, 09/07,	03/98, 05/98, 12/00, 05/01, 06/01,	10/92, 12/92, 03/93, 12/93,
	10/05, 11/05, 03/08,	02/08, 07/08, 11/08, 03/09,	01/02, 02/03, 07/06, 03/08, 04/08,	08/94, 02/95, 12/95, 02/96,
	05/09, 09/10, 02/11,	04/09, 07/09, 12/09, 02/10, 12/13	02/09, 01/11, 08/11, 12/11, 03/14	07/97, 11/98, 02/01, 12/02,
	06/13, 08/13, 10/14			01/05, 01/06, 11/07, 01/09,
				05/09, 06/13, 02/15
Number of crises	18	21	25	27

SD: Standard deviation, MP: Market pressure

Table 3: Coefficient estimates of the multinomial Logit model/Jordan

Variables	($Y=-1$)	ME ($Y=-1$)	($Y=1$)	ME ($Y=1$)
RER	2.483 (2.911)	0.172 (0.187)	-2.428** (1.143)	-0.564** (0.276)
M2R	-0.791** (0.372)	-0.947** (0.426)	0.061** (0.027)	0.034** (0.016)
Δ DC	-18.372* (5.815)	-0.744* (0.238)	11.462 (10.113)	0.757 (0.584)
AL	-1.328** (0.652)	-0.219** (0.107)	1.942 (1.068)	0.215 (0.179)
Δ X	1.056 (2.408)	0.076 (0.083)	-3.142*** (1.523)	-0.461*** (0.226)
Δ M	0.842 (1.073)	0.143 (0.245)	2.670 (5.061)	1.853 (1.778)
Δ IP	-0.934 (1.737)	-0.086 (0.096)	2.006 (3.724)	0.017 (0.095)
Constant	-1.761** (0.752)	-	-7.457** (3.114)	-
LR statistic (df=17)	56.24		Log likelihood	-148.271
P	0.000			

Standard error in brackets, *** and ** indicates significant at 1%, 5% and 10%, respectively. LR: Likelihood ratio, MP: Market pressure, RER: Real exchange rate

Table 4: Coefficient estimates of the multinomial Logit model/Egypt

Variables	(Y=-1)	ME (Y=-1)	(Y=1)	ME (Y=1)
RER	1.617 (4.051)	0.664 (0.735)	-1.817* (0.562)	-1.173* (0.344)
M2R	2.356 (8.077)	0.228 (0.903)	-2.700** (1.096)	-0.098** (0.037)
ΔDC	-1.781* (0.045)	-0.632* (0.026)	0.251 (3.486)	0.213 (1.675)
AL	-0.884** (0.402)	-0.437** (0.196)	1.905 (3.357)	0.114 (0.291)
ΔX	9.206 (8.250)	0.052 (0.077)	12.769* (3.028)	0.607* (0.148)
ΔM	2.288** (1.104)	0.072** (0.034)	0.127 (1.124)	0.075 (0.147)
ΔIP	-4.209* (1.086)	-0.230* (0.054)	-0.455 (1.753)	-0.070 (0.085)
Constant	-0.852 (2.486)	-	-7.211*** (3.805)	-
LR statistic (df=17)	58.16		Log likelihood	-167.604
P	0.002			

Standard error in brackets. *** and ** indicates significant at 1%, 5% and 10%, respectively. LR: Likelihood ratio, MP: Market pressure, RER: Real exchange rate

that part of the Egyptian exports is a significant source of foreign currencies. However, growth in imports is also found significant in this model but with a relatively small ME. In addition, the growth in industrial production index (ΔIP) is also found significant with the anticipated negative sign in affecting the currency crisis in this model.

For both models, the likelihood ratio statistic, which is testing whether the coefficients are simultaneously significantly different from zero, confirms the general statistical significance of the first and second models at the 1% level of significance.

5. CONCLUSION

This research is an attempt to develop an EWS for two different countries and compare the empirical outcomes among them. The comparison is based on explaining any potential currency crisis in Jordan and Egypt through identifying a number of leading indicators that can help our understanding of the crisis. To achieve these objectives, a MP index was constructed and employed in a multinomial Logit model, using monthly data for Jordan and Egypt covering the time period from January 1980 to December 2015.

The analysis used in this paper is based on transforming the MP to a binary variable and include it in our estimation. From the main empirical results, it is concluded that RER, money supply-reserves ratio (M2R), growth rate of domestic credit (ΔDC), Central Bank foreign assets to liabilities ratio (AL), and growth of exports play a significant role in explain the currency crises for both Jordan and Egypt economies. However, the money supply-reserves ratio is the one of the best indicators in predicting currency crisis for Jordan, while the RER is one of the best for the case of Egypt. The results also indicate that MEs of the previous variables are varying, and they are consistent with theory in terms of sign. It is therefore, recommended that the tools of monetary policy are important in playing a significant role to prevent the currency crisis. Central Banks will also have to work on several other initiatives. They must prepare emergency response guidelines to deal with a crisis.

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