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Capital Flight and the Real Exchange Rate in Resource Scarce MENA Countries

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Abstract

We analyze the determinants of capital flight in three resource scarce MENA countries namely Egypt, Morocco, and Tunisia. Our methodology involves both the linear and the nonlinear autoregressive distributed lag (ARDL) cointegration approach, with a focus on asymmetric relationships between capital flight and the real exchange rate in order to distinguish the effects of overvaluation or undervaluation of the domestic currency on capital flight. Based on annual data between 1975 and 2019, we demonstrate that capital flight responds more to the real exchange rate undervaluation in Egypt, and that the Arab Spring has resulted in higher capital flight in Egypt and Morocco in the long run. Our results also reveal that the real GDP growth rate and inflation are important factors affecting capital flight in Morocco, while the lagged values of capital flight and the institutional quality are more prevalent in Tunisia.

Keywords: Capital flight, Institutional quality, Real exchange rate, MENA, ARDL

1 Introduction

Neo-classical theory suggests that capital should be flowing from capital abundant rich countries to the capital scarce poor countries. However, it has been observed that while many developing countries try

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to attract foreign capital inflows, the residents of these countries actually move the scarce capital out of the country. This phenomenon, which is referred to as 'capital flight' has seemed to undermine efforts for sustainable growth and development in developing economies. The existence of capital flight can be observed in the MENA region as well, with empirical estimates showing large amounts of capital to flee to the developed countries (Almounsor, 2005). If these funds could be held at home, they could be utilized to help increase investment, undertake structural reforms, provide employment, and achieve higher growth rates. Therefore, examining the determinants of capital flight is an important research question especially for the resource scarce MENA countries, which continue to face many macroeconomic challenges. If the drivers of capital flight can be identified, the necessary policy actions can be taken so that these funds can be used domestically.

Despite its importance, there are only a few papers examining the problem of capital flight in the MENA countries. Almounsor (2005) provides the first estimates of capital flight for the MENA region, and finds that both macroeconomic and political environment play an important role on capital flight. Al-Fayoumi *et al.* (2011) investigate the determinants of capital flight in MENA countries for the period between 1981-2008 by using panel data methodology and find that lagged capital flight, external debt, foreign direct investment and the real GDP growth rate are the main factors affecting capital flight. Demir (2004) explores the determinants of capital flight in Turkey, and argues that there is a two way causal relation between external debt and capital flight. Mnif *et al.* (2018) explore the determinants of capital flight in Tunisia between 1980 and 2014 using OLS, cointegration and ECM approaches and find that corruption, political instability and external debt servicing encourage capital flight. Heydari and Jariani (2020) investigate the determinants of capital flight in 21 MENA countries for the period between 2000 and 2018 by applying a panel data GMM approach, and suggest that an increase in economic growth rate and more transparency may help reduce capital outflows. In a different GMM analysis including five MENA countries (Algeria, Lebanon, Iraq, Turkey and Yemen), Yaseen *et al.* (2018) consider the link between capital flight, terrorism and the institutional quality and conclude that improvements in institutional quality cause a reduction in capital flight.

Against this background, we contribute to the literature in two ways: First, we aim to provide further insights to the phenomenon of capital flight by undertaking a time series analysis. Most of the aforementioned studies examine the determinants of capital flight by undertaking a panel data study.

Although this approach can provide valuable insights, country case studies are also required in order to analyze the role of different country characteristics on capital flight. Surely, the MENA countries differ from each other in terms of the size of the economy, dependence on natural resources, as well as institutional quality. Therefore, a country level analysis can help us better understand the dynamics of capital flight. As a result, we focus on three countries namely Egypt, Morocco, and Tunisia; which are categorized as resource-poor MENA countries by the World Bank (2007). Our analysis investigates both the linear and the nonlinear cointegration relationships between capital flight, real GDP growth rate, institutional quality, inflation rate, and the real exchange rate.

The second main contribution of our paper is that we examine the possible asymmetric effects of real exchange rate on capital flight. In the existing empirical studies, it is generally assumed that the relation between capital flight and the real exchange rate is symmetric. However, in the literature, it is argued that overvaluation of the currency can increase the fear of depreciation and thereby induce capital flight (Hermes *et al.*, 2002; Gouider and Nouira, 2014), while undervaluation can also lead to more capital outflows (Vos, 1992). Nevertheless, the current empirical literature dealing with the asymmetric effects of real exchange rate on capital flight is limited. Gouider and Nouira (2014) analyze the effect of exchange rate misalignment on capital flight for a set of developing countries including some MENA countries by using panel OLS fixed effects and the GMM methods. Bosupeng *et al.* (2019) examine the relation between exchange rate misalignment and capital flight in Botswana, and conclude that in the long run currency overvaluation increases capital flight. To the best of our knowledge, there is no study analyzing the determinants of capital flight as well as the possible asymmetric relation between capital flight and the real exchange rate by undertaking a country specific time series approach. As a result, we focus on the three resource scarce MENA countries for which data is available, and employ an autoregressive distributed lag (ARDL) model developed by Pesaran *et al.* (2001) as well as the nonlinear ARDL (NARDL) model proposed by Shin *et al.* (2014). We specifically examine whether the changes in real exchange rate have an asymmetric effect on capital flight. Furthermore, we also examine the impact of the Arab Spring, and investigate whether it has contributed to an increase in capital flight in these three countries in the long run.

The outline of the study is as follows: Section 2 explains the data set used in the analysis. Section 3 describes the methodology used, while Section 4 presents the empirical results. Finally, Section 5 concludes with a discussion of the policy implications.

2 Data

We use data obtained from three countries for which all data is available for a sufficient time period. The countries included in the analysis are Egypt, Morocco and Tunisia.

Our dependent variable is capital flight. Although there are various definitions of capital flight, in the current paper, we define capital flight as the unrecorded capital outflows by the residents of a developing country. Different approaches have been proposed in the literature to estimate capital flight. These approaches are namely the residual method, Dooley method and the hot money method. Among these approaches, the residual method originally developed by the World Bank (1985), has been used commonly in the literature. This definition is often called “residual” or “broad” definition of capital flight, which means that items that are not accounted for in officially recorded capital flows are captured in the residual and this estimate gives capital flight (Yalta, 2009). According to this method, capital flight is calculated as the discrepancy between the sources of capital inflows (i.e., net increases in external debt and the net inflows of foreign investment) and the uses of capital flows (i.e., the current account deficit and additions to foreign reserves). The discrepancy between sources and uses of capital flight gives the amount of capital flight. Capital flight is estimated as follows:

$$\mathrm{CF}_t = \Delta\mathrm{AE}_t + \mathrm{FI}_t - \mathrm{CA}_t - \Delta\mathrm{R}_t \tag{1}$$

Where CF refers to capital flight, $\Delta\mathrm{AE}$ refers to changes in external debt, FI is the sum of foreign direct investment and portfolio investment, CA is current account balance and $\Delta\mathrm{R}$ is the change in total reserves at time t. If the estimated capital flight is positive, it means that sources of capital inflows exceeds the uses of capital inflows thereby indicating the existence of capital flight. If estimated capital flight is negative, on the other hand, it shows that there is capital repatriation.

Figure 1 illustrates the trends in capital flight in the countries in the sample. It is seen that capital flight exhibited large fluctuations in all of three countries. Capital flight was a major problem in Egypt especially during the early 1980s. Throughout the period between 1989 and 1999, Egypt experienced capital repatriation. It is also clearly evident from the figure that capital flight increased significantly during the Arab Spring in 2011, reaching 14 per cent of GDP. A similar trend is observed in Morocco as well. The share of capital flight in GDP reached 36 per cent in 1977 and then it decreased gradually. Although Morocco enjoyed a phase of capital repatriation until 2010, capital flight increased suddenly following the Arab Spring. Compared to Egypt and Morocco, capital flight seems to be more severe in Tunisia. In most of the sample period, there was capital flight, except for a short period of capital repatriation in 1989, 2008 and 2009. Capital flight in Tunisia amounted to 11 per cent in 2011 and it remained high since then.

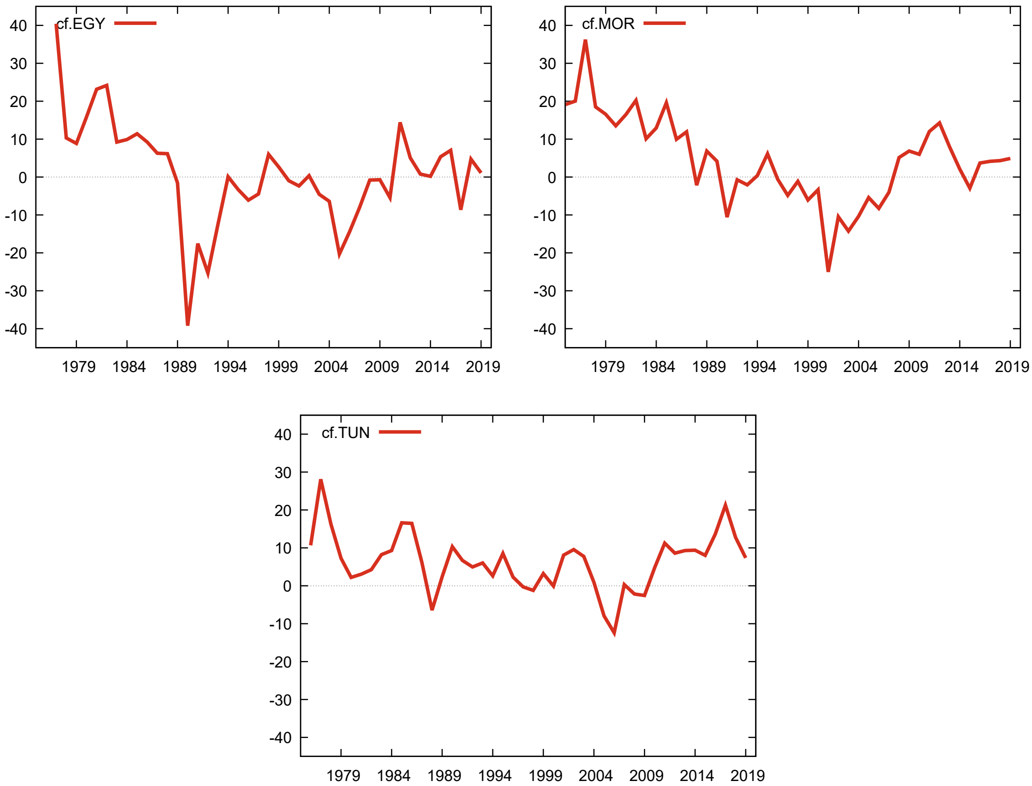

Figure 1: Time series plots of capital flight as a percentage of GDP for Egypt, Morocco, and Tunisia (Left to right, top to bottom).

As observed in Figure 1, capital flight exhibit large fluctuations during the sample period. In order to identify what factors are responsible for the changes in the magnitude of capital flight, we rely on the existing literature. Various factors have been pointed out in the literature as determinants of capital flight including real GDP growth rate, inflation rate, real exchange rate and political and institutional factors. One of the most important determinants of capital flight cited in the literature is macroeconomic environment. In terms of macroeconomic environment, real GDP growth rate and inflation rate seem to be the main factors contributing to capital flight. Most of the literature on capital flight suggests that higher real GDP growth rate reduces capital flight (Pastor, 1990; Al-Fayoumi *et al.*, 2011). The existing literature also indicates that inflation plays an important role on the magnitude of capital flight. By affecting the risk and return from investment, inflation may cause higher capital flight as investors trying to maximize their profits flee their funds abroad.

It has also been found that real exchange rate plays an important role in capital flight (Lessard and Williamson, 1987; Pastor, 1990; Gouider and Nouira, 2014; Bosupeng *et al.*, 2019). However, the literature on the effect of real exchange rate is inconclusive. While some authors argue that real exchange rate overvaluation increases capital flight by increasing the fear of depreciation, some find that real exchange undervaluation increases capital flight by affecting the return of the investment and creating uncertainty. Therefore, to analyze whether real exchange rate overvaluation or undervaluation have an effect on capital flight, we distinguish between the increases and decreases in real exchange rate.

The literature suggests that institutional quality may be one of the main drivers of capital flight since lower institutional quality creates uncertainty and an unfavorable economic environment (Alesina and Tabellini, 1989; Fatehi and Gupta, 1992; Fatehi, 1992; Loungani and Mauro, 2001; Le and Rishi, 2006; Cerra *et al.*, 2008; Hasnul and Masih, 2016; Asongu and Nwachukwu, 2017). Poor institutional quality is mostly associated with poor investment environment, low levels of growth rates and greater uncertainty and therefore encourages capital flight. The evidence shows that as institutional quality improves, capital flight decreases (Yaseen *et al.*, 2018).

We also analyze the effect of "Arab Spring" on the magnitude of capital flight in Egypt, Morocco, and Tunisia. It is known that the Arab Spring has significantly affected the economic and financial environment in these countries. High political and economic uncertainty aftermath the civil unrest caused massive capital outflows in affected countries. The residents of these countries tried to protect their wealth in the face of unprecedented events by taking their savings abroad, which contributed to massive capital flight. To account for the effect of these events, we construct a dummy variable which takes a value of 1 after 2011, zero otherwise.

The data required for the calculation of capital flight is taken from World Development Indicators by the World Bank (2020). The data on economic growth and inflation are obtained from the same database. The data on real exchange rate is retrieved from the Bruegel database constructed by Darvas (2012). The data for institutional quality is obtained from the Polity IV database, which consists of various dimensions of institutional quality such as the competitiveness of political participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive (Marshall and Jaggers, 2007). Therefore, it is expected that capital flight might increase with lower institutional quality.

3 Methodology

3.1 Linear ARDL model

To examine whether a cointegration relation exists between capital flight, economic growth institutional quality, inflation and real exchange rate we apply ARDL bounds testing approach pioneered by Pesaran *et al.* (2001). ARDL approach has several advantages: First of all, while some of the cointegration tests such as Engle and Granger (1987) and Johansen (1988, 1991) require that all variables should be integrated in the same order, ARDL approach can be used even if the variables under consideration are integrated in different orders. Furthermore, this approach allows us to analyze the behaviors of the variables both in the long run and in the short run. Last but not least, ARDL approach is shown to be robust even for small sample sizes.

Following Pesaran *et al.* (2001), we present the error- correction model as follows:

$$\begin{aligned}\Delta\mathrm{CF}_t = \alpha \sum_k^p \beta_k \Delta\mathrm{CF}_{t-k} + \sum_k^p \gamma_k \Delta\mathrm{Y}_{t-k} + \sum_k^p \lambda_k \Delta\mathrm{IQ}_{t-k} + \sum_k^p \Omega_k \Delta\mathrm{RER}_{t-k} \\ + \sum_k^p \delta_k \Delta\mathrm{INF}_{t-k} + \theta_1\mathrm{CF}_{t-1} + \theta_2\mathrm{Y}_{t-1} + \theta_3\mathrm{IQ}_{t-1} + \theta_4\mathrm{RER}_{t-1} + \theta_5\mathrm{INF}_{t-1} + \epsilon_t\end{aligned} \tag{2}$$

Where Y refers to the real GDP, IQ is institutional quality, INF is the inflation rate and RER is the real exchange rate. The parameters β, γ, λ, Ω, and δ represent the short term coefficients. $\theta_{1,2,3,4,5}$ are the long run multipliers and ϵ is the error term assumed to be serially uncorrelated.

The model tests whether the lagged levels of the variables had a significant effect on the dependent variable. The null and alternative hypothesis of this test are given as follows:

$$\begin{aligned} &\mathrm{H}_0 : \theta_1 = \theta_1 = \theta_3 = \theta_4 = \theta_5 \\ &\mathrm{H}_0 : \theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq \theta_5 \end{aligned} \tag{3}$$

F statistics is used to test the above hypothesis. Pesaran *et al.* (2001) provide critical values for the upper and lower bounds for each confidence levels. If the computed statistics exceeds the upper bounds, the null hypothesis is rejected, indicating cointegration among the variables. On the other hand, if the F statistics is lower than the lower bounds, it is decided that there is not any cointegration between lagged level variables. Finally, if the calculated F statistics falls between the two critical value bounds, the result becomes inconclusive.

To provide evidence on the adjustment process towards equilibrium, we employ an error correction model as suggested by Pesaran *et al.* (2001). The long run lagged level variables in Equation 2 ($\theta_{1,2,3,4,5}$) are replaced with one lagged error correction term. This error correction term must be negative and significant.

3.2 Nonlinear ARDL model

Although most of the literature assumes that the relation between real exchange rate and capital flight is linear, it is possible that real exchange overvaluation and undervaluation may have asymmetric effects on capital flight. To evaluate whether there is a nonlinear relation between real exchange rate and capital flight, we employ a nonlinear autoregressive distributed lag analysis. Following Shin *et al.* (2014), we distinguish between real exchange rate over valuation by $\Delta\mathrm{RER}+$ and undervaluation by $\Delta\mathrm{RER}-$. These are simply defined as a partial sum of negative and positive changes as follows:

$$
\begin{aligned}
\mathrm{RER}_t^+ &= \sum_{j=1}^{t} \Delta\mathrm{RER}_j^+ = \sum_{j=1}^{t} \max(\Delta\mathrm{RER}_j, 0) \\
\mathrm{RER}_t^- &= \sum_{j=1}^{t} \Delta\mathrm{RER}_j^- = \sum_{j=1}^{t} \min(\Delta\mathrm{RER}_j, 0)
\end{aligned} \tag{4}
$$

The nonlinear ARDL model is written as:

$$
\begin{aligned}
\Delta\mathrm{CF}_{i,t} = \alpha \sum_{k}^{p} \omega_k \Delta\mathrm{CF}_{t-k} + \sum_{k}^{p} \varphi_k \Delta\mathrm{Y}_{t-k} + \sum_{k}^{p} \tau_k \Delta\mathrm{IQ}_{t-k} + \sum_{k}^{p} \rho_k \Delta\mathrm{RER}_{t-k}^+ + \sum_{k}^{p} \mu_k \Delta\mathrm{RER}_{t-k}^- \\
+ \sum_{k}^{p} \tau_k \Delta\mathrm{INF}_{t-k} + \gamma_1 \mathrm{CF}_{t-1} + \gamma_2 \mathrm{Y}_{t-1} + \gamma_3 \mathrm{IQ}_{t-1} + \gamma_4 \mathrm{RER}_{t-1}^+ + \gamma_5 \mathrm{RER}_{t-1}^- + \gamma_6 \mathrm{INF}_{t-1} + \epsilon_t
\end{aligned} \tag{5}
$$

To test for the asymmetric effects of real exchange rate on capital flight, we consider the estimates of RER_{t-k}^+ and RER_{t-k}^-. Using the Wald test, we decide whether the two partial sums carry the same coefficient in sign and size to identify whether they are symmetric or asymmetric.

4 Empirical findings

Before the model estimation procedure, we employ unit root testing in order to make sure that the variables are not I(2), because the ARDL model cannot be applied in this case. As a result,we check the stationarity of the variables with the Augmented Dickey Fuller Test (ADF). Table 1 presents the unit root test results for each country. As can be seen in the Table, capital flight, GDP growth rate and $\mathrm{RER}-$ are stationary at the levels, while the other variables are stationary at the first differences.

After confirming that none of the variables are I(2), we proceed with testing the existence of a long run linear cointegration between the variables. Table 2 presents the findings from the ARDL bounds testing. It is seen that the calculated F statistics are greater than the upper bound critical value for all countries. Therefore, the null hypothesis of no cointegration is rejected and it is concluded that there exists a long term relationship between the model variables.

Table 1: ADF unit root test results

	Egypt		Morocco		Tunisia	
Variable	**Levels**	**First differences**	**Levels**	**First differences**	**Levels**	**First differences**
CF	-3.822^{**}	-8.512^{***}	-2.595	-9.870^{***}	-4.660^{***}	-5.950^{***}
GDP_GR	-3.746^{**}	-10.312^{***}	-11.800^{***}	-11.597^{***}	-6.569^{***}	-9.267^{***}
POLITY2	-2.162	-6.591^{***}	-0.373	-7.285^{***}	-0.218	-6.320^{***}
INF	-3.469^{**}	-10.414^{***}	-1.792	-10.693^{***}	-2.513	-7.553^{***}
RER	-3.072	-4.908^{***}	-2.464	-11.567^{***}	-2.111	-5.314^{***}
RER+	-3.816^{**}	-6.422^{***}	-5.593^{***}	-11.265^{***}	-6.658^{***}	-8.935^{***}
RER−	-4.785^{***}	-6.762^{***}	-4.399^{***}	-11.301^{***}	-5.345^{***}	-7.320^{***}

Note: ADF regressions include both intercept and trend. *, ** and *** denote rejection of the null hypothesis of unit root at the 10%, 5%, and 1% significance levels respectively.

Table 2: ARDL bounds test results

Country	**F-statistic**	**Long run relationship**
Egypt	4.18^{**}	Cointegration
Morocco	5.27^{**}	Cointegration
Tunisia	6.25^{***}	Cointegration

Note: *, ** and *** denote significance at 1%, 5%, and 10% levels respectively. Critical bounds of the F-statistics are provided by Pesaran *et al.* (2001). Akaike Information Criteria is used for the optimal lag length.

The long run coefficients are given in Table 3. In Egypt, inflation rate is negatively related with capital flight, while real exchange rate is positively related. One unit change in real exchange rate leads to a 0.23 per cent increase in capital flight. It is also seen that the Arab Spring had a positive effect on capital flight. In Morocco, inflation and the Arab Spring seem to have positive and significant effects on capital flight. The coefficient estimate shows a 1.33 percent increase in capital flight in response to one percent increase in inflation. However, real exchange rate does not have a significant effect on capital flight in Morocco. In Tunisia, real GDP growth rate is negatively associated with capital flight. A percentage increase in real GDP growth rate leads to a 1.22 percentage decrease in capital flight. Another significant variable for Tunisia is real exchange rate, which is positively related with capital flight. This may be related with the fact that exchange rate overvaluation may increase the fear of devaluation and cause higher levels of capital flight. The institutional quality does not seem to have a positive effect on capital flight in none of the countries in the sample in the long run. Finally, it is observed that for all countries Arab Spring has a positive and significant effect on capital flight.

Table 3: Long-run coefficient estimates for the linear ARDL Model

	Egypt	**Morocco**	**Tunisia**
	ARDL(1,1,0,1,1)	ARDL(1,2,0,0,0)	ARDL(2,1,1,0,1)
GDP_GR	1.930	1.613	-1.220^{*}
	(1.156)	(1.106)	(0.683)
POLITY2	0.191	-2.624	0.304
	(2.230)	(2.462)	(0.384)
INF	-0.589^{*}	1.338^{*}	0.869
	(0.318)	(0.771)	(0.527)
RER	0.231^{***}	0.186	0.227^{***}
	(0.064)	(0.122)	(0.071)
SPRING	21.635^{***}	18.570^{***}	9.275^{*}
	(6.568)	(6.284)	(4.308)
TREND	-0.671^{***}		
	(0.266)		

Note: *, ** and *** denote significance at 1%, 5%, and 10% levels respectively.

Next, we examine the short run dynamics. The estimates of the conditional error correction model are given in Table 4. We use the Akaike Information Criterion (AIC) to choose the optimum lag lengths. In Egypt, real exchange rate has a positive effect on capital flight. In Tunisia, lagged capital flight has a significant effect on current level of capital flight. Lagged capital flight is found to be an important driver of capital flight in the literature. Higher levels of capital flight in the past can result in more capital flight in subsequent years indicating that capital flight can be persistent (Ndikumana and Boyce, 2003). In addition to the real exchange rate, institutional quality has also a significant and negative impact on capital flight in Tunisia. A one per cent increase in institutional quality seems to reduce capital flight by 0.90 per cent. This result is in line with that of Mnif *et al.* (2018) who found that amount of capital flight is affected significantly by institutional environment. In Morocco, lagged value of GDP growth rate plays an important role in capital flight. Apparently, lower growth rates in the past creates uncertainty in macroeconomic environment and leads to more capital flight. Unlike Egypt and Tunisia, real exchange rate does not have a significant effect in Morocco. However, the effect of inflation on capital flight is positive and significant. In all countries, the error correction term is negative and significant as expected.

Finally, we perform the standard diagnostic tests. First, we test for the autocorrelation using LM test. We do not reject the null hypothesis of no serial correlation. Then, we test the stability of the short-term and long-term estimated coefficients. CUSUM and CUSUMSQ results, presented in Table 4 show that the parameters are stable.

Table 4: Error correction representation for the linear ARDL Model

	Egypt	**Morocco**	**Tunisia**
	ARDL(1,1,0,1,1)	ARDL(1,2,0,0,0)	ARDL(2,1,1,0,1)
D(CF(−1))			0.360^{*}
			(0.130)
D(GDP_GR)	-0.392	-0.050	-0.333
	(0.562)	(0.254)	(0.205)
D(GDP_GR(−1))		-0.475^{*}	
		(0.253)	
D(POLITY2)	-0.998	-1.566	-0.903^{*}
	(1.960)	(2.525)	(0.437)
D(RER)	0.203^{***}	0.248	0.558^{***}
	(0.037)	(0.279)	(0.145)
D(INF)	0.094	0.710^{*}	0.644
	(0.191)	(0.410)	(0.582)
SPRING	3.323	16.535^{***}	5.488
	(7.131)	(6.517)	(3.700)
C	9.392^{***}	-35.394^{***}	-18.224^{***}
	(1.875)	(8.450)	(3.417)
COINTEQ(−1)	-0.819^{***}	-0.710^{***}	-0.899^{***}
	(0.119)	(0.166)	(0.149)
R-SQ	0.68	0.74	0.77
LM	0.66	0.49	0.10
DW	2.08	1.95	2.46
CUSUM	S	S	S
CUSUM-SQ	S	S	S

Note: *, ** and *** denote significance at 1%, 5%, and 10% levels respectively. Optimal lag length is chosen based on AIC.

After finding the existence of linear cointegration between the variables, we proceed with the estimation of the nonlinear ARDL model. Utilizing this approach allows a further exploration of the cointegration dynamics. Here, our main objective is to explore the possible asymmetric effect of real exchange rate changes on capital flight. In other words, we aim to distinguish between the effects of exchange rate overvaluation and undervaluation. Thus, in the next step we check whether there exists a nonlinear cointegration relation between the variables. The F statistics obtained from the NARDL model are provided in Table 5. It is seen that F statistics exceed the critical values, and therefore we conclude that there is nonlinear cointegration between the variables.

Table 5: Asymmetry-nonlinear ARDL results

Country	**F-statistic**	**Long run relationship**
Egypt	4.42**	Nonlinear cointegration
Morocco	4.09**	Nonlinear cointegration
Tunisia	4.21**	Nonlinear cointegration

Note: *, ** and *** denote significance at 1%, 5%, and 10% levels respectively. Critical bounds of the F-statistics are provided by Pesaran *et al.* (2001).

The long run results are presented in Table 6. Here, we see that in Egypt real exchange rate undervaluation plays a significant role in capital flight. Decreases in exchange rate undervaluation leads to an increase in capital flight. Also, the Arab Spring has a significant effect. On the other hand, in Morocco, an increase in inflation rate leads to an increase in capital flight. However, the effect of real exchange rate is not significant. Finally, in Tunisia, an increase in real GDP growth rate causes a decrease in capital flight. Similar to Egypt, real exchange rate undervaluation is positively related with capital flight in Tunisia as well.

As for the short run effects, we obtain similar results. In Egypt and Tunisia, real exchange rate undervaluation causes an increase in capital flight. Similar to linear estimation results, we see that in Morocco, lagged GDP growth rate is positively associated with capital flight. Another important determinant of capital flight in Morocco is inflation rate. A one percent increase in inflation rate leads to a 0.93 per cent increase in capital flight. In Tunisia, lagged value of capital flight has a positive effect on capital flight, while real GDP growth rate has a negative effect. A one percent increase in real GDP growth rate causes a 0.52 per cent decrease in capital flight. Unlike Egypt and Morocco, institutional quality seems to play a significant effect on capital flight. Similar to Egypt, real exchange rate undervaluation is positively related with capital flight.

In order to verify whether real exchange rate has an asymmetric impact on capital flight, we

Table 6: Long-run coefficient estimates for the nonlinear ARDL Model

	Egypt	**Morocco**	**Tunusia**
	ARDL(1,1,0,1,1)	ARDL(1,2,0,0,0)	ARDL(2,1,1,0,1)
GDP_GR	2.025	2.362^{*}	-2.292^{*}
	(1.275)	(1.358)	(1.293)
POLITY2	-0.068	-2.285	0.510
	(2.406)	(2.866)	(0.542)
INF	-0.325	1.954^{**}	0.137
	(0.324)	(0.810)	(0.943)
RER+	0.041	0.562	-0.718
	(0.222)	(1.940)	(1.049)
RER−	0.362^{***}	-0.044	0.939^{*}
	(0.122)	(0.828)	(0.517)
SPRING	20.577^{***}	19.059^{*}	10.010
	(7.036)	(7.436)	(5.909)
TREND	-0.642^{**}		0.625^{***}
	(0.287)		(0.293)

Note: *, ** and *** denote significance at 1%, 5%, and 10% levels respectively.

check if two partial sums have the same coefficient in sign and size. As can be seen in Table 7, the coefficients of negative and positive changes of real exchange rate have different size both in the long and the short run. However, the asymmetric effect of real exchange rate must be verified with the use of Wald test as well. Denoted by WALD-S in the table, the test results of the short term asymmetry show that real exchange rate has an asymmetric effect on capital flight in Egypt with the null of symmetry of coefficients being rejected at 5 per cent level. For Morocco and Tunisia, however, the short run symmetry hypothesis is not rejected. Furthermore, as usual we provide diagnostic test results to show that our model is valid, there is no serial correlation and parameters are stable.

5 Conclusion

Although capital flight represents lost resources and erodes the efforts for sustainable growth in developing countries, there are only few papers analyzing the determinants of capital flight for the MENA countries. A careful examination of the literature reveal that the existing studies are mainly based on panel data analysis. Furthermore, the studies undertaking a country level analysis implicitly as-

Table 7: Error correction representation for the nonlinear ARDL Model

	Egypt	Morocco	Tunusia
	ARDL(1,1,0,1,1)	ARDL(1,2,0,0,0)	ARDL(2,1,1,0,1)
D(CF(−1))			0.250^{**}
			(0.119)
D(GDP_GR)	-0.250	-0.042	-0.521^{*}
	(0.565)	(0.320)	(0.285)
D(GDP_GR(−1))		-0.557^{*}	0.397
		(0.288)	(0.269)
D(POLITY2)	-1.891	-1.483	-1.015^{**}
	(1.966)	(2.585)	(0.477)
D(RER+)	0.025	0.673	-0.628
	(0.137)	(0.781)	(0.481)
D(RER−)	0.252^{***}	0.151	0.428^{**}
	(0.042)	(0.381)	(0.176)
D(RER−)(−1)	-0.103^{*}		
	(0.045)		
D(INF)		0.936^{**}	-0.034
		(0.433)	(0.632)
SPRING	2.356		5.134
	(7.277)		(3.991)
C	7.821^{***}	-22.931^{***}	27.103^{***}
	(1.692)	(6.013)	(4.568)
COINTEQ(−1)	-0.854^{***}	-0.651^{***}	-0.799^{***}
	(0.127)	(0.168)	(0.134)
R-SQ	0.69	0.90	0.77
LM	0.85	0.45	0.39
DW	1.96	1.65	2.08
WALD-S	3.42**	0.63	0.47

Note: *, ** and *** denote significance at 1%, 5%, and 10% levels respectively. Optimal lag length is chosen based on AIC.

sume that the relation among the variables is symmetric, neglecting the possible nonlinear dynamics. Our study aims to contribute to this scarce literature by examining the relation between capital flight, real GDP growth rate, institutional quality and real exchange rate using both linear auto regressive distributed lag (ARDL) and nonlinear autoregressive distributed lag (NARDL) models for Egypt, Morocco and Tunisia for the period between 1975 and 2019. We also investigate the asymmetric effects of real exchange rate on capital flight for selected countries utilizing NARDL approach for the first time in the literature.

Our empirical results provide evidence for both linear and nonlinear cointegration among the model variables. Furthermore, the findings indicate that different factors affect the magnitude of capital flight in each country. While the real GDP growth rate and the inflation rate are important factors affecting capital flight in Morocco, the lagged values of capital flight and the institutional quality seem to be more important in Tunisia. We also show that the Arab Spring has caused an increase in capital flight in Egypt and Morocco in the long run. Last but not least, the NARDL analysis, which allows us to examine the effects of real exchange overvaluation and undervaluation separately, reveals that real exchange rate has an asymmetric effect on capital flight only in Egypt in short run, while short run asymmetry has not been confirmed for Morocco and Tunisia.

Our findings have a number of important policy implications as well. In Morocco, the policy makers should give a special emphasis to improve the macroeconomic environment, since achieving higher real GDP growth rates and following monetary policies to reduce inflation rate can be helpful in combating with the capital flight problem. In Tunisia, however, the main focus needs to be the institutional quality as improvements in institutional quality is strongly associated with capital flight.

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