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Determinants of Exchange Rate Practices in the MENA Countries: Some Further Empirical Results

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Determinants of Exchange Rate Practices in the MENA Countries:
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This paper analyses the determinants of exchange rate practices in 15 MENA countries for the 1977-2007 period placing special emphasis on structural and macroeconomic explanations. We use three different exchange rate regime classifications in order to avoid potentially misleading specification. Even though the empirical results using the *de facto* classifications are very different from those obtained from the *de jure* specification, we find that international reserves play a major role in determining exchange rate practices in the MENA countries.

1. Introduction

The choice of exchange rate regime has always been one of the most important subjects in international macroeconomics. Since the publication of Robert Mundell's "A Theory of Optimum Currency Area", we have seen a large amount of literature trying to tackle this crucial issue to identify how countries choose their exchange rate regimes. According to the theory of optimum currency areas, this choice is made on the basis of some structural and macroeconomic factors such as the size, the degree of openness or the level of economic development of a particular country. Another set of literature emphasizes political and institutional factors such as political instability, central bank independence or the government temptation to inflate as important criteria influencing the choice of exchange rate regime. In this case, the choice between pegged and flexible exchange rate regimes becomes a pure political decision that depends on the degree of credibility of policy makers. For instance, by adopting a credible peg, a country's inflationary bias would theoretically converge to the relatively lower bias of the stable reserve-currency country and thus a possible credibility gain would be realized. Finally, following the numerous currency crises that shook the international monetary system in the mid-nineties, several researchers have suggested that the choice of an exchange rate regime is mainly determined by the level of financial integration and the degree of capital account openness of a country.

In a previous work[1], we investigated the determinants of exchange rate regimes choice in 17 MENA countries for the 1990-2000 period and found that these countries chose their regimes on the basis of two main structural and macroeconomic factors, namely their degree of economic development and the level of their international reserves. In this paper, we also limit our discussions to empirical aspects related to the determinants of exchange rate regime choice in the MENA countries. We extend our previous work in three different manners. First, we consider in our analysis only potential structural and macroeconomic determinants of exchange rate regime choice since it has been shown in our previous study that other modern theories such as the political view or the capital account openness approach could not adequately explain the choice of exchange rate regime by the MENA countries. Second, we estimate several ordered multinomial Probit models for an unbalanced panel of 15 MENA countries between 1977 and 2007 and use three different *de jure* and *de facto* classifications in order to capture more adequately the choice of exchange regimes by these countries.[2] Our reason for choosing 1977 as the starting date is unavailability of data for earlier years. Finally, we supplement our analysis by computing marginal effects as opposed to simple coefficients since we are interested in analyzing the change in the probability of the different exchange rate regimes in response to changes in the explanatory variables. Our empirical results indicate that the *de jure* regimes describe better the exchange rate strategies implemented in the MENA countries than the *de facto* specifications. Furthermore, we find that among the theoretical long-run determinants proposed by the optimum currency area theory, the level of international reserves seem to adequately determine the choice of exchange rate regime of the MENA countries.

The remainder of this paper is organized as follows. In the second section we describe the evolution of exchange rate strategies in the MENA countries. In section 3, we briefly review the main hypothesis and predictions concerning the choice of an exchange regime as advanced by the

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[1] Sfia, M.D (2007) "The choice of exchange rate regimes in the MENA countries: a Probit Analysis" The William Davidson Institute WP N°899.

[2] The country list is: Algeria, Bahrain, Egypt, Iran, Jordan, Kuwait, Libya, Mauritania, Morocco, Oman, Pakistan, Saudi Arabia, Syria, Tunisia, and Yemen

optimum currency theory. In Section 4, we present the data, methodology and the results of our estimations. Section 5 concludes.

2. Evolution of exchange rate regimes in the MENA countries

Initially, we begin by discussing the main rationales for using *de jure* and *de facto* exchange rate regime classifications. Then, we describe the evolution of regimes in the countries considered in our analysis based on these two categories

2.1 A Word on exchange rate regime classification

For many years (since the early 1950's) the International Monetary Fund (IMF) used *de jure* classifications to describe the shares of fixed versus floating arrangements among its member countries. Although comprehensive in terms of country and historical coverage, this *de jure* classification system had a serious drawback, in practice, exchange rate regimes often differed from what they were officially announced to be. Indeed, many countries that in theory have a flexible rate intervene in exchange markets so pervasively that in practice very little difference exists with countries that have explicit fixed exchange rate regimes. Also, several countries that declare fixed exchange rates undertake periodic and frequent devaluations that it becomes difficult to differentiate the peg from a managed float regime. For many years and until the late 1990's, most empirical studies of exchange rate regime relied on the *de jure* regime classification reported in the IMF's Annual Report on Exchange Rate Arrangements and Exchange Restrictions. Consequently, these empirical analyses risked reaching completely false conclusions and drawing misleading policy implication. Recognizing the merits of classifying regimes more realistically, the IMF switched in 1999 to a mixed (hybrid) *de jure-de facto* classification. This new classification combines the information obtained from specific countries about their exchange rate regime and monetary policy framework with the analysis of the variance of exchange rates, interest rates and official reserves. Despite the considerable progress made by the IMF's *de facto* classification, it remained relatively limited from an empirical angle since it offers a short historical data base.

With the view to addressing this shortcoming, several researchers have tried to generate their own *de facto* classifications. Among these, the classifications of Levy-Yeyati and Sturzenegger (LYS) (2005) and Reinhart and Rogoff's (RR) (2002) are considered as the most important and are the most frequently used in the empirical research on exchange rate regimes today.[3] Unlike the IMF's de jure classification, The LYS classification ignored completely the declarations of countries about their exchange rate and monetary practices to focus only on describing the *de facto* practices by analysing the volatility of the exchange rate and of the official reserves. According to LYS, Floats will be characterised by high variance in the exchange rate and low variance in official reserves while pegged regimes will display low exchange rate variance and large swings in reserves. The authors resorted to the cluster analysis technique to classify exchange regimes into five distinct categories; flexible, dirty float, crawling peg, fixed and inconclusive. The cluster analysis that was applied to all IMF reporting countries over the period 1974-2000 was made in two rounds. After the first round, only 1062 among 2860 observations were classified, the remaining 1798 observations were submitted to the same procedure to reduce the number of inconclusive observations. The second round procedure reclassified 1100 observations. The remaining 698 (24%) observations were finally included in the "inconclusive group". This is considered as the main drawback of the LYS classification. The Reinhart and Rogoff's

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[3] See also Bubula and Ötker-Robe (2002).

classification adopted a broadly similar nomenclature to that of the IMF's *de facto* classification. However, the authors relied on monthly database of exchange regimes for 153 countries over the period 1946-2002, computed a variety of descriptive statistics and distinguished between countries which have a unified exchange market and those where there are multiple exchange rates. The "*Natural*" classification generated by Reinhart and Rogoff (2002) divides exchange regimes into five categories; fixed, limited flexibility, managed floating, freely floating, and freely falling.[4]

To summarize, we can say that exchange rate classifications can be grouped into three different categories. The first is a pure *de jure* classification based exclusively on the country's self description of its regime. The second type of classifications can be described as "*hybrid*" since it combines the self declared regime by one country with information obtained from analysis of statistical data and some specific time series. Finally, the third category of exchange regime classification is a pure *de facto* classification where the self-described regimes are totally ignored by the researchers and where the assignment of countries into fixed, intermediate or floating regime is based solely on the behaviour or variability of exchange rates, international reserves and interest rates.

2.2 Evolution of exchange rate regimes in the MENA countries

In order to characterize the evolution of exchange rate regimes in the 15 MENA countries considered, we need to classify these regimes into categories. As in most empirical works, we classify both the *de jure* (IMF) and the *de facto* (LYS and RR) exchange rate regimes into three principal categories; namely a peg, an intermediate regime and a float. In table 1, 2 and 3, we report the percentages of country observations that fall into these three categories for *de jure* and the *de facto* exchange rate regimes in MENA countries during the whole period as well as during three sample periods i.e. 1977 to 1985, 1986 to 1995 and 1996 to 2007 for the IMF's *de jure* classification, 1996 to 2000 for the LYS classification and 1996 to 2001 for the RR classification.

Table 1: *De jure* exchange rate regime in MENA countries

	Peg %	Intermediate %	Float %
1977- 2007	67.31	5.81	26.88
1977- 1985	88.89	2.96	8.15
1986- 1995	62.00	8.00	30.00
1996- 2007	58.19	6.21	35.59

Notes: (1) The Category denoted Peg comprises hard and conventional peg arrangements.
     (2) The Category denoted intermediary comprises all pegged exchange rates within margins.
     (3) The Category denoted float comprises managed floating and independently floating regimes.
Source: IMF (Various issues).

Table 2: LYS's d*e facto* exchange rate regime in MENA countries

	Peg %	Intermediate %	Float %
1977- 2000	51.53	33.15	15.32
1977- 1985	62.22	31.85	5.93
1986- 1995	46.67	36.00	17.33
1996- 2000	41.89	29.73	28.38

Notes: (1) The Category denoted Peg comprises fixed arrangements.
     (2) The Category denoted intermediary comprises intermediary and basket arrangements
     (3) The Category denoted float comprises floating regimes.
Source: Levy-Yeyati and Sturzenegger (2005).

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[4] Countries whose twelve-month rate of inflation is above 40 percent.

Table 3: RR's *de facto* exchange rate regime in MENA countries

	Peg	Intermediate	Float
	%	%	%
1977- 2001	10.93	76.80	12.27
1977- 1985	16.30	70.37	13.33
1986- 1995	4.67	80.67	14.67
1996- 2001	13.33	80.00	6.67

Notes: (1) The Category denoted Peg comprises hard and conventional peg arrangements.
(2) The Category denoted intermediary comprises all pegged exchange rates within margins.
(3) The Category denoted float comprises managed floating and independently floating regimes.
Source: Reinhart and Rogoff (2002)

Table 1 shows the evolution of the three aggregated exchange rate regimes categories over the three periods considered based on the IMF's *de jure* classification. We can easily see that despite a marked decline in their share, pegged exchange rate regimes remained the more dominant type of monetary arrangement among the MENA countries. Over the last decade (1996-2007), more than 58 percent of the MENA countries were still pursuing various forms of pegged arrangement compared with 88 percent during the early eighties (1977-1985). This drop in pegged exchange rate regimes is accompanied with a slight increase in the proportion of intermediate regimes from nearly 3 percent to almost 7 percent. Finally, the share of floats has increased significantly from 8.15 percent during the 1977-1985 to nearly 36 percent at the end of the sample period. Thus, the evolution of the *de jure* exchange rates regimes brings out one clear conclusion; there is a discernible trend toward increased flexibility among the MENA countries over the last 30 years. However, the revealed gain in popularity of flexible exchange rate regimes among the MENA countries might just be illusory since the results are based on these countries self-declarations to the IMF. Hence, the trend toward flexibility might be a simple reflection of the "flexibilist" ideas promoted by the IMF i.e. MENA countries describe themselves as floaters because that is what the IMF wants to hear, but in reality they intervene massively to adjust their exchange rates. Thus, we can define their attitude as "fear of the IMF".

In table 2, we present the proportions of the three categories of exchange rate regimes obtained from the LYS classification. As Levy-Yeyati and Sturzenegger (2005) point out, their classification and that of the IMF bear several similarities.[5] This is clearly visible in our results since the trends in exchange rate regimes choice by the MENA countries described by the LYS *de facto* classification are almost comparable to those obtained from the *de jure* classification. While the proportion of pegged exchange rate regimes decreased from 62 percent in the first sub-period to nearly 42 percent during the last decade and that of floaters increased from 5.93 percent to 28.38 percent between the two sample periods, the share of intermediate regimes remained relatively high and stable around 30 percent.

Finally, table 3 describes the evolution of exchange rate regimes in the MENA countries by utilising the RR's *de facto* classification. According to this classification the intermediate regimes have been and continue to be more prevalent in the MENA countries than suggested by the *de jure* or the LYS classifications. While *de jure* intermediate regimes accounted for only 5.81 percent of all exchange rate regimes, the proportion of *de facto* regimes with an intermediate degree of flexibility account for about 75 percent of all *de facto* regimes in the RR classification over the whole period. Moreover, according to the RR classification, the share of MENA countries with

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[5] However, the IMF's (LYS) classification tends to overestimate the share of Flexible (intermediate) exchange rate regimes.

intermediate regimes has increased significantly from 70 percent in the first sample period to 80 percent over the 1996-2001 period. Together with the decrease in the proportions of pegged and floating exchange rate regimes, this trend toward intermediate regime implies a shift away from the two ends spectrum of exchange rate regimes providing strong evidence that intermediary regimes are not vanishing as some proponents of the "hollowing middle" or "the bipolar view" have argued.

Unlike several empirical studies on the evolution of exchange rate regimes in developing countries[6], comparison of the results obtained from the IMF's *de jure*, the LYS's and RR's d*e facto* classifications for the MENA countries suggests that the so-called "middle" along the flexibility dimension continues to constitute a significant proportion of all regimes, as it has throughout the last past three decades. Thus, our results raise serious questions about the validity of the "bipolar" hypothesis in the MENA countries and more generally in developing countries. Starting in the mid-1990's and following the virulent currency crisis in several developing countries, some observers had predicted that emerging market economies, would, over time move to the polar extremes of exchange rate flexibility, that is they would either adopt freely floating regimes or move to hard pegs such as monetary union, currency boards or dollarization.[7] Our results, however, rejects this "bipolar" view and provide strong support for another hypothesis; that is "the middle has been and will always be viable", at least for the MENA countries. Our empirical findings based on the three classifications can also be qualified by two strong other hypothesis. The former, the "fear of floating" hypothesis casts doubts on the view that countries tend to move towards more flexible exchange rate arrangements in a context of increasingly unstable international markets Calvo and Reinhart (2002). The Latter, the "fear of pegging" stresses the increased awareness of speculative attacks, particularly among small open developing economies Levy-Yeyati and Sturzenegger (2005).

3. Structural and macroeconomic determinants of exchange rate regime choices: theoretical predictions and empirical findings

Traditionally, explanations of exchange rate choices built on the optimum currency area and related approaches. Initially, we present the main structural and macroeconomic factors affecting countries probability of choosing an exchange rate regime, and then we review the empirical findings concerning these factors.

3.1 Theoretical predictions on exchange rate choice

The theory of optimum currency area, which originates in Mundell (1961), relates the choice of an exchange rate regime to some long-term determinants that are relatively stable over time. This approach to the fix vs. float dilemma weights the trade and welfare gains from a stable (fixed) exchange rate vis-à-vis the rest of the world (or, more precisely, the country's main trade partners) against the benefits of exchange rate flexibility as a shock adjuster in the presence of nominal

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[6] See for example Fisher (2001) or Bubula and Ötker-Robe (2002) among others.
[7] Summers (2000, p8) wrote that "the choice of appropriate exchange rate regime, which, for economies with access to international capital markets, increasingly means a move away from the middle ground of pegged but adjustable fixed exchange rates towards the two corner regimes of either flexible exchange rates or a fixed exchange rate supported, if necessary, by a commitment to give up altogether an independent monetary policy."

rigidities. According to the "traditional" arguments of the theory of optimum currency area, only sizable countries characterised with structural diversification of their economies, as well as with geographical diversification of their exports and imports, can afford floating exchange rates for their currencies. In consequence, country characteristics such as small size, high openness to trade, and high concentration of trade with a particular partner are more likely to be associated with fixed exchange rate regimes, Mundell (1961), McKinnon (1963), Kenen (1969). The "traditional" optimum currency area theory also stipulates that macroeconomic factors such as the inflation differential of a country vis-à-vis the rest of the world, the level of economic development and the degree of capital mobility may influence the choice of an exchange rate regime system. A higher divergence of a country's inflation to that of its main trading partners would necessitate frequent exchange rate adjustments. As such, similarity of inflation rates would favour a pegged exchange rate regime, Fleming (1973). Regarding the degree of economic development, we would generally expect that the lower it is, the less developed and efficient would be both the goods market and the factor market and consequently the less suitable is a fixed exchange rate regime, Holden, Holden and Suss (1979). Finally, concerning the degree of capital mobility, it is argued that under fixed exchange rates, international capital movements may frustrate the objectives of monetary policy. In contrast, flexible exchange rates may provide a certain degree of monetary independence of a country. Hence, a high degree of capital mobility would likely to be associated with floating exchange rates, Savvides (1990).[8]

Generally, the empirical facts tend to provide strong support for the optimum currency area theory predictions i.e. economies that have high trade openness ratio will opt for fixed exchange rate regimes and advanced and financially integrated countries will have flexible exchange arrangements. Indeed, it is broadly recognised that governments of countries that trade intensively, such as China, have tended to intervene a lot to stabilise the exchange rate of their currencies and thus to have less flexible exchange rate regimes. At the same time, industrialised and advanced economies with low external trade ratios such as the United States, Japan or Australia, with large access for international capital markets, have tended to choose flexible exchange rate regimes. However, where we can easily identify a similar pattern for industrialised and less developed economies, it is by far more difficult to detect a clear pattern for emerging markets.

3.2 Empirical findings on factors affecting exchange rate regime choice

Since the work by Dreyer (1978), Heller (1978) or Holden, Holden and Suss (1979), several empirical studies have been dedicated to the question of exchange rate regime.[9] All these studies looked at structural and macroeconomic factors as potential determinants of the exchange rate regime choice.

Dreyer (1978) is among the first studies of this kind who analysed the determinants of exchange rate regimes with data for 88 developing countries for the year 1976. He relies in his estimates on explanatory variables that are exclusively related to optimum currency theory (size of the economy, openness, geographical and structural diversification) and estimates an ordinal Probit model. His results show that the optimum currency area theory is strongly confirmed; larger countries would tend to opt for higher degree of flexibility while a higher degree of geographical and structural diversification strengthens the tendency toward greater fixity of an exchange regime. Heller's analysis is different from Dreyer's in several ways. He carries out a cross-section analysis involving 85 advanced and developing countries and uses a non parametric statistical technique

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[8] See Table A.1 for more details on Predictions concerning the choice of exchange rate regimes
[9] See Juhn and Mauro (2002).

(Discriminant analysis) to show that a large size, a small foreign trade sector, a high degree of financial integration, a large inflation differential in comparison to the world average and a diversified foreign trade pattern tend to be associated with floaters. While these two studies rely in their analysis on IMF's official *de jure* classification, Holden, Holden and Suss (1979) choose to measure the degree of flexibility of one country's exchange rate regime by computing an exchange rate flexibility index.[10] They estimate a linear equation using ordinary least squares where the flexibility index is the dependent variable and six explanatory variables (openness, capital mobility, external sector's diversification, geographical concentration of trade, degree of economic development and inflation differential) on a cross-sectional data for 75 countries. Their results also provide empirical support for the OCA theory. Following these three main contributions, several other empirical works have tried to analyse the choice of exchange rate regime using many of the optimum currency area variables meanwhile as to assess other newer theories such as the political economy view, the fear of floating hypothesis or the bipolar view. Since a detailed review of these empirical works including an explanation of their methodological differences or similarities is beyond the scope of this paper, suffice is to say that the majority of these studies provide large support for the optimum currency area theory suggesting that individual structural and macroeconomic factors could have exercised an influence on the choice of exchange rate regime.[11]

4. Data, variables definitions and estimations results

Our analysis of the potential determinants of exchange rate regimes choices involve many of the explanatory variables that have been suggested by theory and used in previous empirical studies. Detailed definitions and data sources are given in Appendix (table A.3).

4.1 Data and variable definitions

For our empirical analysis, we concentrate on the exchange rate regimes adopted by 15 MENA countries after the break down of the Bretton Woods system i.e. during the 1977-2007 period.[12] Unless indicated otherwise, The World Bank Development indicators (WDI) database is the main source for the independent variables. The structural and macroeconomic potential determinants of exchange rate regimes we include in our analysis are the following:

Optimum Currency area variables

- Economic Size: GDP in U.S. dollars at purchasing power parity (PPP).
- Level of economic development: GDP per capita in U.S. dollars at PPP.
- Degree of Openness: ratio of imports plus exports to GDP.
- Geographical concentration of trade: Share of trade with the largest trading partner: exports to the largest trading partner as a share of total exports, from the IMF's *Direction of Trade Statistics*.
- Inflation Differential: difference between inflation in the country and inflation in the USA.
- Degree of capital mobility: ratio of Gross private capital flows to GDP.

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[10] The index of exchange rate flexibility of a country is measured by the ratio of the sum of the absolute value of monthly percentage changes in the trade-weighted exchange rate to the sum of the absolute changes in official holdings of foreign exchange expressed in US dollars divides by the sum of imports plus exports. See Holden, Holden and Suss (1979) for more details.

[11] See Table A.2 for more details.

[12] Estimations using the LYS and the RR *de facto* classifications are for the periods 1977-2000 and 1977-2001, respectively.

Macroeconomic variables

- International reserves: Total reserves in months of imports.
- Current account: ratio of current account balance to GDP.
- Growth: GDP growth (annual %).
- Domestic credit: ratio of domestic credit to private sector to GDP.

Data for the dependent variable, exchange rate regime, are collected from the IMF's *Exchange Rate Arrangements and Exchange Restrictions* Annual Reports, as well as from the papers LYS (2005) and RR (2002). Previous studies used various methods and techniques to measure the variable "exchange rate regime". These range from discriminant analysis, Heller (1978), flexibility index and Ordinary Least Squares, Holden, Holden and Suss (1979), Poirson (2001) to Probit and Logit models with discrete qualitative choice variables. The latter consist of the following categories: two regimes with fixed and flexible rates, Dreyer (1978), Savvides (1990), Bosco (1987), three regimes with fixed, intermediate, and float Bosco (1987), Rizzo (1998), Sfia (2007) and four or more regimes with single-currency peg, basket peg, crawling peg and float, Melvin (1985), Juhn and Mauro (2002). In our analysis, we also describe the choices of exchange rate regimes using a discrete variable $Y_{i,t}$. Following our classifications (section 2.2), this variable can take one of the following three values:

$$Y_{i,t} = \begin{cases} 0, & \text{if a fixed exchange rate regime is chosen by country i in year t,} \\ 1, & \text{if country i chooses an intermediate exchange rate regime in year t} \\ 2, & \text{if a flexible exchange rate regime is chosen by country i in year t,} \end{cases}$$

4.2 Estimations results

Before turning to regression analysis, we have to choose the appropriate model that we will consider in the rest of our study. In other words, we have to decide whether we must choose a Probit or a Logit specification for our regressions.

4.2.1 The baseline model of regime choice

The problem of interest can be described as wanting to estimate the following relation:
$$Y_{it}^* = \beta' x_{it} + \varepsilon_{it} \text{ for i = 1,2...N ; t = 1,2...}T_i$$

Where Y_{it}^* the unobserved dependent variable, x_{it} is is a vector of independent variables, β is a vector of coefficients, N is the number of countries and T_i denotes the number of observations for country *i*. The econometric literature on panel data models suggests employing a specific fixed-effects model for a particular set of countries. However, it has been shown that the maximum likelihood estimator that we use in our estimations is inconsistent in a country-specific fixed effects model, Chamberlain (1980). Therefore, we use the random effects model in order to control for country-heterogeneity and assume that:

$$\varepsilon_{it} = v_{it} + u_i$$
$$Var(\varepsilon_{it}) = (\sigma_v^2 + \sigma_u^2) = 1 + \sigma_u^2$$

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$$Corr(\varepsilon_{it}, \varepsilon_{is}) = \rho = \frac{\sigma_u^2}{1 + \sigma_u^2}$$

Where u_i is a country specific random component that is constant across time and $u_i \sim N(0, \sigma_u)$, v_{it} is a normally distributed error term, $v_i \sim N(0, \sigma_v)$ and $\sigma_v = 1$. Since Y_{it}^* is unobserved, what we observe in the exchange rate regime analysis is:

$$Y_{i,t} = \begin{cases} 0, & \text{if } Y_{it}^* \leq \mu_0 \\ 1, & \text{if } \mu_0 \leq Y_{it}^* \leq \mu_1 \\ 2, & \text{if } \mu_1 \leq Y_{it}^* \end{cases}$$

More specifically, we assume that a country chooses a fixed exchange rate regime if the dependent variable falls below a specific threshold μ_0. If the dependent variable is between two thresholds μ_0 and μ_1, the country is presumed to choose an intermediate regime. Finally, if the dependent variable exceeds μ_1, the country is assumed to adopt a flexible exchange rate regime.

The probability of each regime being chosen is:

$$\Pr ob(Y_{it} = 0) = \Psi(\mu_0 - \beta' x_{it} - u_i)$$
$$\Pr ob(Y_{it} = 1) = \Psi(\mu_1 - \beta' x_{it} - u_i) - \Psi(\mu_0 - \beta' x_{it} - u_i)$$
$$\Pr ob(Y_{it} = 2) = 1 - \Psi(\mu_1 - \beta' x_{it} - u_i)$$

In order to estimate such a model, we have to make some assumptions about the distribution of the errors terms i.e. about the form of $\Psi(.)$. We assume that the error term ε_{it} follows the logistic or normal distribution. In the first case we have:

$$\Psi(-\beta' x_i) = \frac{\exp(-\beta' x_i)}{1 + \exp(-\beta' x_i)} = \frac{1}{1 + \exp(\beta' x_i)}$$

In the Probit model, the cumulative function is given by:

$$\Psi(-\beta' x_i) = \int_{-\infty}^{-\beta' x} (2\pi)^{-1/2} \exp(-t^2/2) dt$$

Since the two functional forms are very close to each other, the results obtained using one of them are likely to be not very different, unless the sample is large and there are many observations on the tails, Maddala (1983). Also, because the information criteria of Akaike, Schwartz and Hannan-Quinn do not indicate a clearly superior model, we assume that the error term ε_{it} is *i.i.d* with a normal distribution having a mean of zero and variance of one. Logit estimations provide similar results so that our choice of a normal distribution does not have excessive influence on analysis.

4.2.2 Estimations results from a multinomial ordered Probit model

In this section we report the empirical evidence concerning the importance of the hypothesis emanating from the optimum currency area and macroeconomic theories to the choice of exchange rate regimes in the MENA countries. As, stated before, the base specification is estimated with

data for 15 MENA countries using both *de jure* and *de facto* classifications. We use one period lagged series for all the explanatory variables in order to mitigate simultaneity problems which would arise from using contemporaneous values for these variables.[13] Before turning to the regression analysis, we examine the pairwise matrix of correlation coefficients of the potential determinants of exchange rate regimes. The results reported in table A.5 indicate that there is no obvious sign of multicollinearity.

Table 4 reports the results of the specification of the *de jure* exchange rate regimes. The determinants of choosing among fixed, intermediate or flexible exchange rate regimes were estimated using multinomial ordered Probit analysis.[14] A positive (negative) sign of a coefficient means that an increase in the associated variable raises the probability of adopting a floating (pegged) exchange rate regime.

Table 4: Determinants of exchange rate regimes, IMF *de jure* classification 1977-2007

	Coef.	Z-statistic.	Marginal effects.
Variable			
GDP	7.37e-12	-1.1	--
Gdpper	-0.0001117	-2.47***	-0.0002
Open	-2.000434	-2.07***	-3.89
Geoc	-0.0277578	-1.74**	-0.059
Infd	-0.0459024	-2.91***	-0.076
CapM	0.0032946	3.43***	0.001
Res	-0.0920198	-2.06***	-0.17
Cagdp	0.0028287	0.18	--
Growth	-0.0238367	-0.95	--
Credit	-0.0076505	-0.67	--
Log likelihood	-162.83322		
LR $\chi^2(9)^a$	34.98		
Pseudo-R^{2b}	0.111		

[a] The x^2 value is defined as $2(L_1-L_0)$ where L_0 is the value of the log-likelihood function containing only the constant term and L_1 is the value of the log-likelihood function including all explanatory variables.

[b] For Probit models, the R^2 statistic is meaningless. Hence, we report an appropriate measure of goodness of fit, i.e. the Pseudo-R^2.

* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Although, the variable GDP has the expected sign it has no significant role in the selection of *de jure* exchange rate regimes. However, the variables Open and Geoc have all (expected) meaningful economic signs and are statistically significant suggesting that economies that are characterized with a high degree of openness as well as with a high concentration of trade would tend to opt for fixed exchange rate regimes. Furthermore, the variable CapM has a positive and statistically significant sign indicating that countries that are open to capital markets are more willing to float. These findings provide strong support for the optimum currency area theory. On the other hand, the coefficient characterizing the variable Gdpper (level of development) has a negative sign which contradicts the optimum currency area theory. Indeed, our results indicate that an economy is less likely to adopt a flexible exchange rate regime if it is more developed. This result is completely in line with our previous findings for the MENA countries in Sfia (2007). A possible interpretation for this result is that the more an economy is developed, the more it is diversified and the stronger the case for fixed exchange rates. Regarding the variable Infd, we find that a large inflation

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[13] See table A.4 for some descriptive statistics for each of the explanatory variables.

[14] The model is estimated by the log-likelihood function introduced by Butler and Moffitt (1982). The Gauss-Hermite quadrature method deals with the random effects structure in the model.

differential in comparison to the world average strengthens the tendency toward greater fixity of an exchange regime, also a result that contradicts the optimum currency area theory predictions. Nevertheless, this result is consistent with the credibility hypothesis which stipulates that a high inflation country has much to gain from pegging its currency to the currency of a low inflation country or from joining a monetary union. Finally, concerning the macroeconomic determinants of exchange rate regimes, the coefficients of the variables Caddp, Growth and Credit are not significant. However, the variable characterizing the level of reserves has a negative and significant sign. This result supports the hypothesis that economies characterised with high levels of international reserves tend to adopt fixed exchange rate regimes as large reserves can enhance the sustainability of such regimes. Table 4 also reports the marginal effects on the probability of choosing a fixed or a flexible exchange rate regime.[15] The marginal effects of changes in independent variables indicate the increase in the probability of adopting a fixed (flexible) exchange rate regime due to a unit-increase in the explanatory variable under consideration. For, example the estimated marginal effects of Open reported in the table indicate that an increase in the ratio of total trade to GDP by one percent increases the hypothetical country's probability of adopting a fixed exchange rate regime by 3.89 percent and decreases the probability of adopting a floating regime by 3.89 percent.

Table 5 reports the results of the specification of the LYS's *de facto* exchange rate regime. We note significant differences between the results for the *de facto* and the *de jure* categories. These results are not surprising given the fact that we observed some discrepancies between the two types of classifications. First, the two goodness of fit measures, a LR test statistic distributed as $\chi^2 (9)$ for each model, and the pseudo-R^2 suggest that the LYS *de facto* specification exhibits a lower explanatory power than that of the *de jure* one. We also note that only four variables are individually significant in contrast with the *de jure* model in which six variables are significant. Regarding the optimum currency area theory, two out of six coefficients (Gdpper and Open) are significant. Moreover, the signs of these coefficients are in line with the predictions of theory, namely less developed economies characterised with high degree of openness favour pegged exchange rate regimes. From table 5, we also can see that an increase by one percent in the openness (level of development) of a country raises the probability of adopting a pegged (flexible) exchange rate regime by 3.95 (2.2) percent. However, contrary to the *de jure* exchange regimes, the variables GDP, Geoc, infd and CapM seem to play no significant role in the selection of *de facto* exchange rate arrangements. As in the *de jure* classification, higher levels of international reserves increase the probability of choosing a peg. Finally, we find that the variable Credit is statistically significant with a positive sign suggesting that countries that are characterized with high levels of domestic credit to the private sector are more likely to choose a flexible exchange rate regime. The variable Credit measures the health of the financial system and is generally perceived by market participants as positively related to the degree of flexibility since an expansion in bank credits is likely to increase the ratio of bad loans to good loans, which leads to speculative attacks on the currency, Sachs, Tornell and Velasco (1996).

Table 5: Determinants of exchange rate regimes, LYS *de facto* classification 1977-2000

	LYS 1977-2000	Z-statistic	Marginal effects
Variable			
GDP	-1.57e-12	0.075	--
Gdpper	4.58e-08	3.72***	2.2
Open	-2.648875	-3.98***	-3.95
Geoc	-0.001628	-0.17	--

---

[15] Marginal effects are reported only when the variable is significant.

Infd	-0.0062561	-0.70	--
CapM	-0.0073665	-1.19	--
Res	-0.2477252	-4.60***	-0.35
Cagdp	0.0579595	4.59	--
Growth	-0.0160636	-1.00	--
Credit	0.0087563	2.03***	0.00028
Log likelihood	-180.40684		
LR $\chi^2(9)^a$	1.52		
Pseudo-R^{2b}	0.005		

[a] The x^2 value is defined as $2(L_1-L_0)$ where L_0 is the value of the log-likelihood function containing only the constant term and L_1 is the value of the log-likelihood function including all explanatory variables.

[b] For Probit models, the R^2 statistic is meaningless. Hence, we report an appropriate measure of goodness of fit, i.e. the Pseudo-R^2.

* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Finally, the results obtained using the RR *de facto* classification are presented in table 6. As in the LYS specification, The RR *de facto* specification presents a lower explanatory power than that of the IMF *de jure* one. Among six optimum currency area variables only half of them are significant. More precisely, we find that the level of economic development, the degree of trade concentration and the degree of capital mobility increase the probability of adopting flexible exchange rate regimes. Marginal effects for these variables indicate that an increase by one percent in Gdpper, Geoc and CapM raises the probability of adopting flexible exchange rates respectively by 2.2 percent, 0.036 percent and 0.0025 percent. Turning to macroeconomic variables, our results show, as in the previous estimations, that the variables Res has a negative and significant sign indicating that the level of international reserves remains an important determinant of regime choice among the MENA countries.[16] We also find that the variable Credit is significant and that its coefficient has a negative sign. A result that contradicts the previous one obtained from the LYS classification. Finally, the variable Growth is significant and bears a negative sign. This indicates that countries with poorer economic performances will tend to prefer more rigid exchange rate arrangements. However we expected that higher growth rates would be associated with flexible exchange rate regimes since economic recessions can increase the probability of currency crisis and encourage the implementation of floating exchange arrangements. According to Edwards (1996), our result can be interpreted as providing evidence in favour of the credibility theory and the "tying its own hands" hypothesis. In other words, countries that are characterized with low growth rates will have great incentives to renege on their low inflation promises and, thus, will benefit from adopting a more rigid exchange-rate system.

Table 6: Determinants of exchange rate regimes, RR *de facto* classification 1977-2001

	RR 1977-2001	Z-statistic	Marginal effects
Variable			
GDP	8.87e-12	0.165	--
Gdpper	2.12e-08	2.19**	2.2
Open	1.530469	0.898	--
Geoc	0.0572406	5.37***	0.036
Infd	-0.0012423	-0.13	--
CapM	0.005126	3.86***	0.0025
Res	-0.1044341	-2.49***	-0.186
Cagdp	0.0041407	3.18	--
Growth	-0.0468493	-2.89***	-0.078
Credit	-0.0096466	-1.57**	-0.021

[16] This results is also consistent with our previous findings in Sfia (2007).

Log likelihood	-127.91916		
LR $\chi^2(9)^a$	20.76		
Pseudo-R^{2b}	0.079		

[a] The x^2 value is defined as $2(L_1-L_0)$ where L_0 is the value of the log-likelihood function containing only the constant term and L_1 is the value of the log-likelihood function including all explanatory variables.

[b] For Probit models, the R^2 statistic is meaningless. Hence, we report an appropriate measure of goodness of fit, i.e. the Pseudo-R^2.

* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Conclusion

This paper investigated empirically the determinants of exchange rate regime choice in 15 MENA countries. The explanatory variables used included two sets of criteria emanating from the optimum currency area and macroeconomic theories. We considered three different measures of the dependent variable, choice of exchange regime, in order to avoid potentially misleading classification, namely the IMF's (official) *de jure,* the LYS and the RR *de facto* choice of exchange rate regimes.

The empirical results obtained from the *de jure* classification indicate that exchange rate regime choices are largely consistent with the predictions of the optimum currency area theory during the period under consideration. Countries that are characterized with a high degree of openness as well as with a high concentration of trade would tend to opt for fixed exchange rate regimes. However, regarding the variable level of economic development, we find that more developed economies tend to opt for pegged exchange rate regimes. Among the macroeconomic variables, our results show that international reserves play important roles in the regime choice. The results using the *de facto* classifications are very different from those obtained from the *de jure* specification. Regression results using the LYS classification indicate that developed (open) economies characterized with high credit expansion (international reserves) are more likely to adopt flexible (fixed) exchange rate arrangements. Turning to regressions from the RR classification, again we do not find regularities in the results. Nevertheless, as in the previous regressions, we find that high international reserves play a major role in determining exchange rate regime choices in the MENA countries. Hence, analysis of the determinants of exchange rate regimes practices brings one clear conclusion; high international reserves strengthen the tendency toward fixed exchange rate regimes among the MENA countries.

Appendix A

Table A.1: Predictions concerning the choice of exchange rate regimes

Structural and macroeconomic characteristic	Preferred regime
Large size	Flexible
High economic development	Flexible
High openness	Fixed
High concentration of trade with a partner	Fixed
High inflation differentials	Flexible
High capital mobility	Flexible
High level of international reserves	Fixed
High ratio of current account to GDP	?
High growth	Flexible
High credit to the private sector	Flexible

Table A2: Studies on determinants of Exchange rate Regimes (Likelihood to Float)

Author	Heller (1978)	Dreyer (1978)	Holden, Holden and Suss (1979)	Melvin (1985)	Bosco (1987)	Savvides (1990	Cuddington and Otoo (1990, 1991)
Sample	86 countries	88 developing countries	76 countries	64 countries	92 developing countries	39 developing countries	125 countries
Time Frame	1976	1976	1974-75 (monthly)	1976-78	1978, 1979 and 1980	1976-84	1991
Methodology							
Explanatory variables	Discriminant analysis	Probit	OLS on a continuous measure	Multinomial Logit	Binomial Logit, multinomial Logit and ordered probability analysis.	Two-stage Probit	Logit and Probit
Optimum Currency Area Factors							
Openness	-	-	-	-	-	-	+/-
Economic development			+			+	
Size of economy	+	+		+			+
Inflation differential	+		+	+	+	-	+
Capital mobility			-		+	+	
Geographical trade concentration	-	-	-	-	-		
International financial integration	+						
Other macroeconomic/external/Structural factors							
Growth							
Negative growth							
Inflation							
Moderate to high inflation							
Reserves							
Capital control							
Terms of trade volatility							
Variability in export growth							
External variability * Openness							
Real exchange rate volatility							+	
Product diversification			-			-	
Current account							
External debt							
Growth of domestic credit							
Money shocks					-		-
Foreign price shocks					+		+

Source: Adapted from Juhn and Mauro (2002)

Table A2: Studies on determinants of Exchange rate Regimes (Likelihood to Float)

Author	Honkapohja and Pikkarainen (1992)	Collins (1996)	Edwards (1996)	Edwards (1998)	Rizzo (1998)	Frieden, Ghezzi and Stein (2000)	Berger, Sturm and de Haan (2000)
Sample	125 countries	24 Latin American and Caribbean countries	63 countries	49 developing and middle–income	123 countries	26 Latin American countries	65 developing countries
Time Frame	1991	1978-92	1980-92	1980-92	1977-95	1960-94	1980-94
Methodology							
Explanatory variables	Logit and Probit	Probit (panel)	Probit (panel)	Probit (panel)	Probit	Ordered Logit (panel)	Probit (panel)
Optimum Currency Area Factors							
Openness	-	+			+	-	+
Economic development	-		+	-	+/-		
Size of economy	+	+			+		
Inflation differential							
Capital mobility							
Geographical trade concentration					-		
International financial integration							
Other macroeconomic/external/Structural factors	+/-						
Growth							
Negative growth			+	+			+
Inflation		-					
Moderate to high inflation							
Reserves							
Capital control							
Terms of trade volatility							
Variability in export growth							
External variability * Openness							
Real exchange rate volatility						+	
Product diversification		-				-	
Current account							
External debt							
Growth of domestic credit							
Money shocks					-		-
Foreign price shocks					+		+

Source: Adapted from Juhn and Mauro (2002)

Table A2: Studies on determinants of Exchange rate Regimes (Likelihood to Float)

Author	Poirson (2001)	Von Hagen and Zhou (2002)	Juhn and Mauro (2002)	Méon and Rizzo (2002)	Papaioannou (2003)	Levy Yeyati, Sturzenegger, and Reggio (2002)	Bleaney and Francisco (2005)
Sample	93 countries	25 transition economies in Central and Eastern Europe and the CIS	184 countries	125 countries	6 central American countries	183 countries	102 developing countries
Time Frame	1990-98	1990-1999	1990, 1995, 1999, 2000	1980-1994	1974-2001	1974-1999	1990-2000
Methodology							
Explanatory variables	Ordered probit	Static/dynamic ordered Logit models	Bivariate Probits and multinomial Logits	Binomial Probit (Panel)	Multinomial Probit/Logit	Binomial Logit (Panel)	Binomial/ordered Logit
Optimum Currency Area Factors							
Openness	-	-	+/-	-	-	-	+
Economic development	+/-	-	+/-	+	+		-
Size of economy	+	-	+	-	+	+	+
Inflation differential							
Capital mobility			+/-			+	
Geographical trade concentration	+	-	+/-	+	-	-	
International financial integration		+			-	+	
Other macroeconomic/external/Structural factors							
Growth							
Negative growth	-				+		
Inflation	+						
Moderate to high inflation		+	+/-		+		+
Reserves	-						
Capital control	-	-	+/-				
Terms of trade volatility	+		+/-				
Variability in export growth			+/-	+	-	+	
External variability * Openness							
Real exchange rate volatility							
Product diversification		-			-		
Current account	+	-					
External debt							
Growth of domestic credit					-		-
Money shocks							
Foreign price shocks							

Source: Adapted from Juhn and Mauro (2002)

Table A2: Studies on determinants of Exchange rate Regimes (Likelihood to Float)

Author	Markiewicz (2006)	Sfia (2007)
Sample	23 transition countries	17 MENA countries
Time Frame	1993-2002	1990-2000
Methodology		
Explanatory variables	Ordered Logit	Probit models (Panel)
Optimum Currency Area Factors		
Openness		
Economic development		+
Size of economy	+	-
Inflation differential	+	+/-
Capital mobility		-
Geographical trade concentration		+/-
International financial integration	+	+/-
Other macroeconomic/external/Structural factors		
Growth		
Negative growth		
Inflation	-	
Moderate to high inflation		
Reserves	+/-	-
Capital control		+/-
Terms of trade volatility		+/-
Variability in export growth		
External variability * Openness		
Real exchange rate volatility		
Product diversification		
Current account		
External debt		
Growth of domestic credit		
Money shocks		
Foreign price shocks		

Source: Adapted from Juhn and Mauro (2002)

Table A.3: Variables, definitions and data sources

Variable	Definition	Source
• *Optimum currency area variables*		
GDP	GDP in U.S. dollars at purchasing power parity	WDI
Gdpper	GDP per capita in U.S. dollars at PPP	WDI
Open	Ratio of imports plus exports to GDP	WDI
Geoc	Exports to the largest trading partner as a share of total exports	DOTS
Infd	Difference between inflation in the country and inflation in the USA.	WDI
CapM	Ratio of Gross private capital flows to GDP	WDI
• *Macroeconomic variables*		
Res	Total reserves in months of imports	WDI
Cagdp	Ratio of current account balance to GDP	WDI
Growth	GDP growth (annual %)	WDI
Credit	ratio of domestic credit to private sector to GDP	IFS

Notes: WDI = World Bank World Development Indicators.
   DOTS = Direction of Trade Statistics.
   IFS= IMF's International Financial Statistics.

Table A.4: Summary Statistics of Explanatory Variables Used in the Analysis

Variables	Ods.	Mean	Std Error	Min.	Max.
GDP	438	7.73e+10	9.07e+10	1.07e+09	5.04e+11
Gdpper	439	8.98e+08	1.87e+10	0	3.92e+11
Open	399	0.2255731	0.2373015	0.0211871	1.420069
Geoc	446	26.61002	10.47089	7	63.2
Infd	418	4.53459	9.579035	-29.32249	55.74349
CapM	403	48.94853	482.7734	0	9522
Res	379	2751.919	27003.63	0.5475839	402384
Cagdp	410	2858.759	29910.32	-240.4958	445980
Growth	388	3.819214	5.614056	-20.61553	33.99047
Credit	398	37.4777	21.15938	3.010304	104.3225

Table A.5 : Pairwise correlations matrix, 15 MENA countries, 1977-2007

	IMF	LYS	RR	Gdp	Gdpper	Open	Geoc	Infd	CapM	Res	Cagdp	Growth	Credit
IMF	1.0000												
LYS	0.4338	1.0000											
RR	0.0270	0.1035	1.0000										
Gdp	0.3827	0.1288	0.2307	1.0000									
Gdpper	-0.0338	-0.0502	0.0385	-0.0062	1.0000								
Open	-0.3318	-0.2295	0.1243	-0.2732	0.0298	1.0000							
Geoc	-0.1098	-0.0730	0.3245	-0.0010	0.0516	0.0154	1.0000						
Infd	0.0703	0.1252	0.0638	0.0945	-0.0207	-0.3629	0.0497	1.0000					
CapM	0.0851	-0.1416	0.1825	0.0005	-0.0050	0.2095	0.0196	-0.0440	1.0000				
Res	0.0099	-0.1540	0.0035	-0.0441	-0.0051	-0.0531	0.0599	-0.0280	-0.0197	1.0000			
Cagdp	-0.0634	-0.0168	0.0296	0.1359	-0.0046	0.0210	0.0380	-0.0474	0.0142	0.5840	1.0000		
Growth	0.0622	-0.0023	-0.1879	-0.0184	-0.0869	-0.1566	0.0100	0.0081	0.0740	0.0136	-0.0138	1.0000	
Credit	-0.1325	0.0306	-0.1980	-0.0256	-0.1058	0.1208	-0.3316	-0.1651	0.1675	-0.0556	-0.0272	-0.0653	1.0000

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