The regional pricing of risk: An empirical investigation of the MENA equity determinants

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Abstract

Using a sample of five-MENA emerging countries (Egypt, Tunisia, Morocco, Jordan, and Turkey) during the period 1996-2013, this study highlights the main factors that might influence regional integration of stock markets. We propose an advantageous econometric approach based on a conditional version of the International Capital Asset Pricing Model (ICAPM) to explore major sources of time-varying risks. We specifically apply the multivariate BEKK-GARCH process to simultaneously estimate the ICAPM for each country. The study puts in evidence that inflation, volatility of exchange rates, yield spread, current account deficit, dividend yield and economic growth are among the key determinants of regional integration in the MENA context whatever is the measure of exchange rate risk.

Keywords: Multivariate GARCH, regional integration, ICAPM, MENA

JEL Classification: F36, C32, G12.

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I. Introduction

The MENA region consists of 28 countries from Northern Africa and the Middle East. In addition to their geographical location and political tensions between Israel and its neighbors, this region is important to the world economy, because it holds 60% of global oil reserves. However, more and more economists are interested in the development of financial markets in this region. Indeed, MENA countries provide liquidity to financial markets by the petrodollars coming from oil exports. Besides, recent studies like Creti et al, 2014 and Guesmi and Fattoum, 2014 find a strong correlation between the stock market indices of oil-exporting countries and their financial markets. Thus, several studies analyze the economic dynamics of the financial markets in this region. Especially, some empirical studies have allowed a better understanding of MENA equity market integration as well as its determinants, Darrat et *al.*, 2000; Yu and Hassan, 2008. Furthermore, Guesmi et al, 2014 study the dynamics of regional financial integration of MENA countries with the international financial markets. They find that financial integration evolves through times and is affected by inflation, exchange rate volatility, rate spread variations and world market dividend yield. Again, Guesmi and Teulon, 2014 find evidence for a good level intra-regional integration among MENA countries, despite the complex political and economic situation in the region.

However, most of those studies mainly rely on the concept of market correlation that does not accurately reveal the true patterns of developing market integration. Correlations might divulge worthwhile information about allocation and management of portfolio. But, they cannot thoroughly evaluate either diversification benefits or overall integration (Carrieri et al., 2007). They cannot be an exhaustive measure of integration as two highly integrated markets may be lowly correlated (Pukthuanthong and Roll, 2009). Indeed, two markets are greatly integrated but feebly correlated whenever their returns are differently sensitive to the same determinants. Besides, market co-movements only reveal sector linkages instead of market integration as correlation between markets greatly depends on the level of international trade (Adler and Dumas, 1983). Research on market integration should be hence built on asset pricing model framework, which requires that systematic risks should be similar (Bekaert and Harvey, 1995; Bhattacharya and Daouk, 2002).

This article focuses on the determinants of integration through regional pricing of risk within the MENA region during the period that spans from 1996 to 2013. Indeed, the pricing of risk allows us to better apprehend the level of diversification of portfolio investment within the region, but it also allows us to capture the level of integration. Because, the more integrated markets in this region will be, the less it will be possible for investors to protect themselves against risk by a diversification of their portfolio investment through assets of financial markets within the region.

Our sample is made up with countries like Egypt, Jordan, Morocco, Turkey and Tunisia. We choose those countries in our sample because of their specificities among other MENA countries. Indeed, these countries experienced an average growth rate of 4% over the last decade, despite the Arab Spring that hit Egypt and Tunisia. Egypt is the only oil producing country within the sample. It is also part of the three North African countries with Morocco and Tunisia with very active stock exchanges as compared to the African continent standards. Besides, we have incorporated in our sample countries such as Jordan and Turkey. Jordan has always been a haven of stability in comparison to its neighbors like Iraq and

Syria. Finally, Turkey is the 17th nation of the G20. Therefore, it represents a considerable economic power in the MENA region, despite the fact that it is not an oil producing countries. Concerning the evolution of financial and economic indicators, the following statistics are worth to be noted. Market capitalization of those countries lay between 19,64% in Tunisia and 87% in Jordan, as a percent of GDP in 2012; while stocks traded are between 2.76% of GDP for Tunisia and 44.18% for Turkey. Especially, from 2007 to 2009 the average of stocks traded on stock exchanges of those five countries was around 41%, showing their dynamism during period of international financial distress. Globally, the degree of openness of those countries increased considerably from 51.41% in 1996 to 64.34% in 2013[4], which may have contributed in greater financial integration, Rajan and Zingales, 1998; Bekaert and Harvey, 2000; Bhattacharya and Daouk, 2002 and Carrieri et al., 2007. Those statistics spur our curiosity as to the determinants of regional financial integration in MENA.

The contributions of this paper are two-fold. Firstly, given the exploratory nature of the empirical investigation, we attempt to include as much explanatory variables as possible. We specifically include all the determinants that were potentially mentioned in previous empirical research on market integration. Secondly, we apply a nonlinear econometric approach based on a dynamic International Capital Asset Pricing Model (DY-ICAPM) to model the dynamics of expected returns. Such a model allows exploring not only time-varying market integration but also time-varying covariance risks (Bekaert and Harvey, 1995). We also run the multivariate BEKK-GARCH process of Cappiello et al. (2006) to control for conditional variances and co-variances of stock returns.

The study puts in evidence that dynamics of regional market integration are significantly influenced by trade openness and local stock market development. Empirical results report as well that number and nature of key factors of regional integration widely depend on the measure used to proxy the exchange rate risk. Real exchange rate is here considered as a common source of systematic risk, in addition to local and regional systematic risks.

The paper is structured as follows. Empirical approach is described in Section 2. Data are provided in Section 3. Empirical results are reported and discussed in Section 4. A brief conclusion follows.

II. Empirical approach

We adopt a simplified version of the model that was developed by Bekaert and Harvey (1995) to build our international asset-pricing model. Such a model permits exploring partial integration between a country and other worldwide equity markets. Their model is very appealing as it permits a country to evolve from a developing segmented market to a developed country partially or fully integrated to world equity markets. The proxy of risk in developing markets is the country's variance while it is assessed through the equity returns' sensitivity of once country to international market portfolio's dynamics. Firstly, we consider

[4] Statistics indicated in this paragraph are extracted from the World Development Indicators, World Bank data basis.

a fully integrated regional financial market in which purchasing power parity holds. The conditional version of the model can be written as follows:

$$E_{t-1}(r_{it}) = e^{\delta' X_{reg,t-1}} Cov(r_{it}, r_{reg,t}) \quad (1)$$

Where $E_{t-1}(r_{it})$ is the excess return for the country i, $e^{\delta X_{reg,t-1}}$ is the conditionally expected regional price of covariance risk, $r_{reg,t}$ represents the regional market portfolio return and $Cov(r_{it}, r_{reg,t})$ is the conditional covariance between the security's return and the region market returns.

Bekaert and Harvey, (1995, 1997) suggest the existence of explicit restrictions to capital flows in the case of emerging markets implying that emerging markets may not be fully integrated. In order to take into account for mild segmentation between markets, Errunza and Losq (1985, 1989) propose an extended version of the ICAPM model. In this model, a subset of the assets is available to all investors, while ownership of the remaining assets is restricted to a subset of the investors. Under these assumptions, expected returns dependent on two risk factors: the risk of exposure to global market and exposure to non-diversifiable national risk. According to these assumptions, model (1) can be rewritten as follows:

$$E_{t-1}(r_{it}) = e^{-|g_i' X_{i,t-1}|}\left[e^{\delta_{reg}' X_{reg,t-1}} Var(r_{reg,t}) + \sum_{k=1}^{l} \delta_k' X_{k,t-1} Cov(r_{it}, t_{kt}) \right] + (1 - e^{-|g_i' X_{i,t-1}|}) e^{(\gamma_i' X_{i,t-1})} Var(r_{it}) \quad (2)$$

Where,

t_{kt} is the return on the exchange rate of the currency of country k against the dollar. $\delta_k' X_{k,t-1}$ represents the expected price of the exchange risk for currency k. l is the number of studied markets. Theory does not impose any restrictions on the sign of the price of currency risk, then market investors may be willing to attribute a negative premium to currency deposits if their expected return in excess of the risk-free rate is negative and currency returns have a positive with stock market. $e^{-|g_i' X_{i,t-1}|}$ is the conditional probability of transition between segmentation and integration states. It can be interpreted as conditional measures of integration of market i into the regional market.

$X_{reg,t-1}$, $X_{k,t-1}$ and $X_{i,t-1}$ are respectively a set of regional, exchange rate and local variables. In the case of $e^{-|g_i' X_{i,t-1}|} = 1$, only the covariance risk is priced and the strict segmentation hypothesis is rejected. However, if $e^{-|g_i' X_{i,t-1}|} = 0$, stock markets are perfectly segmented.

The Equation (2) will be simultaneously estimated for the regional market and for our five emerging market sample. Therefore, we have a system containing six equations, where the expected return on the regional market portfolio and the expected return for market i are expressed by the following equations (3) and (4) respectively,

$$E_{t-1}(r_{regt}) = e^{-|g_i' X_{i,t-1}|}\left[e^{\delta_{reg}' X_{reg,t-1}} Var(r_{reg,t}) + \sum_{k=1}^{l} \delta_k' X_{k,t-1} Cov(r_{regt}, t_{kt}) \right] \quad (3)$$

$$E_{t-1}(r_{i,t}) = e^{-|g_i' X_{i,t-1}|}\left[e^{\delta_{reg}' X_{reg,t-1}} Var(r_{reg,t}) + \sum_{k=1}^{l} \delta_k' X_{k,t-1} Cov(r_{it}, t_{kt}) \right] + (1 - e^{-|g_i' X_{i,t-1}|}) e^{\delta_k' X_{k,t-1}} Var_{t-1}(r_{it})$$

(4)

More specifically, the econometric specification of the model to be estimated, i.e., Equations (3) and (4), is characterized by the following system of equations

$$r_{reg,t} = e^{-|g_i' X_{i,t-1}|}\left[e^{\delta_{reg}' X_{reg,t-1}} h_{reg,reg,t} + \sum_{K=1}^{L} \delta_k' X_{k,t-1} h_{reg,k,t} \right] + \varepsilon_{reg,t}$$

$$r_{i,t} = e^{-|g_i' X_{i,t-1}|}\left[e^{\delta_{reg}' X_{reg,t-1}} h_{i,reg,t} + \sum_{K=1}^{L} \delta_k' X_{k,t-1} h_{i,k,t} \right] + (1 - e^{-|g_i' X_{i,t-1}|}) e^{\delta_k' X_{k,t-1}} h_{ii,t} + \varepsilon_{i,t}$$

$$\varepsilon_t / \psi_{t-1} \sim N(0, H_t)$$

(5)

$h_{i,reg,t}, h_{i,k,t} and h_{ii,t}$ are respectively the conditional covariance of the monthly return of the regional stock market index, the conditional covariance of the exchange rate and the conditional variance of the monthly return of the stock local market index and $\varepsilon_{i,t}$ is the residual error term. i and t respectively correspond to country and time. H_t represents the matrix of returns' variance-covariance with

$$H_t = H_0 * (\tau\tau' - aa' - bb') + aa' * \varepsilon_{t-1}\varepsilon_{t-1}' + bb' * H_{t-1} \qquad (6)$$

H_t is the variance-covariance matrix of returns at time *t*. H_0 is the unconditional variance-covariance matrix of the residuals. τ is a vector of ones, *a* and *b* are vectors of unknown parameters, and * denotes the Hadamard matrix product.

The parameters of system of equations (5) and (6) are estimated by maximum likelihood, supposing conditional normally distributed errors. To resolve problems due to a large number of parameters and the non-normality in stock returns, we use quasi-maximum likelihood estimation (QMLE) method, as proposed (see, Bollerslev and Wooldridge, 1992). As Bekaert and Harvey (1995), Hardouvelis et al. (2006) and Guesmi and Nguyen (2014) we estimate the model in two stages. First we estimate a model of the market returns and currency returns, the conditional variances of regional market returns and real exchange rates, their conditional co-variances as well as prices of regional market and exchange rate risk. Second, in the second step, we estimate the complete system to detect the financial integration determinants by introducing the candidate factors of market integration one by one.

III. Data

The paper deals with the integration process within the MENA region with a particular focus on its key determinants. Data of regional stock market indices and real effective exchange rate indices are gathered for the period 1996-2013 on a monthly basis. The sample includes the US and five MENA emerging countries namely Egypt, Jordan, Morocco, Turkey and Tunisia. We would rather use real effective exchange rate (REER) as a proxy to exchange

rate risk as variations in inflation rates are much higher than those of exchange rates in emerging countries. Geometric weighted averages of countries' stock returns against the US dollar are calculated to construct regional market indexes. Market capitalizations constitute the weights. A variety of data sources are used in an effort to extract more and/or better information, namely DataStream International, Federal Reserve Bank of St Louis, and IMF's International Financial Statistic

Instrumental variables are used to explain changes in the world and regional markets' prices and foreign exchange risks. We employ the following variables:

Table 1. List of variables for stock market integration model

Variable	Measurement	References
Trade openness	*TNS* = total trade with the world / Nominal GDP	Rajan and Zingales (1998); Bekaert and Harvey (2000); Bhattacharya and Daouk (2002); Carrieri et *al.* (2007)
Market development	*MDV* = changes of (Market value / Nominal GDP)	Bekaert and Harvey (1995,1997); Levine and Zervos (1998); Bekaert et *al.* (2007) ; Carrieri et *al.* (2007)
Industrial production	*IPR* = Industrial production (IP)	King and Levine (1993); Savvides (1995) ; Odedokun (1996) ; Honig (2008)
Inflation rate	*IFL* = $(CPI_t\text{-}CPI_{t-1})/CPI_{t-1}$	Boyd et *al.* (2001)
Yield spread	*YIS* =log (L.T spread-S.T spread)	Harvey (1991); Hardouvelis et *al.* (2006)
Dividend yield differential	*DIVYD* =DY country i - DY world; *DY* = dividend/price	Ferson and Harvey (1994, 1999); Bekaert and Harvey (1995, 2000);Chari and Henry (2004); Hardouvelis et *al.* (2006)
Exchange rate volatility	*EVL* = conditional volatility generated from an AR(1) process with GARCH(1,1) errors on $\log(Ex_t)$. Exchange rate is expressed in terms of domestic currency per unit of USD	Jorion (1991); Bollerslev et *al.* (1992); De Santis and Gerard (1997); Ng (2004)
Economic growth	*IPG* = Gross Domestic Product (GDP)	King and Levine (1993) ; Savvides (1995) ; Odedokun (1996) ; Honig (2008)
Current account deficit	DCA = Export-Import	Guesmi and Nguyen (2014)
Local market returns	$MRE = \ln(P_t / P_{t-1})$	Guesmi and Nguyen (2014)
Interest rate	*INR* = log (Short term interest rate, TB rate or interbank rate)	Arouri (2006); Carrieri et *al.* (2007); Desroches and Francis (2010)
Difference in industrial production	DIP = *IP* country *i* - *IP* G7	Gurley and Shaw (1967); King and Levine (1993); Arouri (2006)

IV. Results

Table 2 sums up descriptive statistics of sample data. Average excess stock returns range between 0.04% and 0.30% on a monthly basis. The unconditional volatility, as measured by standard deviations, varies from 8.00% (Tunisia) to 9.98% (Jordan). The skewness coefficients are positive for Egypt, Tunisia and Morocco, while they are negative for Jordan and Turkey.

Such statistics foretell that making huge profits is much more probable while investing in Egypt, Tunisia and Morocco than in Jordan and Turkey whose distribution is normal. The kurtosis coefficients are above three in all cases.

Table 2 also report positive exchange rate returns that vary between 0.128 (Tunisia) and 0.537 (Jordan) with a relatively lower unconditional volatility than that of stock market returns. Relative skewness coefficients are all negative while associated kurtosis coefficients are all above three. Taken together, these statistics reveal that both stock and exchange rate returns are asymmetrically distributed and exhibit leptokurtic behavior.

Table 2 – Descriptive statistics of return series

	Mean	Std. dev.	Skewness	Kurtosis	J.B	Q(12)
			Stock Returns			
Egypt	0.003	0.084	0.342	4.524	16.641	168.26
Jordan	-0.004	0.098	-0.266	9.096	221.58	157.52^{+++}
Morocco	-0.009	0.080	0.119	6.385	68.313	70.77^{+++}
Turkey	0.0004	0.018	-0.433	5.054	29.633	107.12^{+++}
Tunisia	0.001	0.012	0.527	4.987	33.78	89.24^{+++}
			Exchange rates			
Egypt	0.214	0.0401	-0.132	4.471	14.434	56.81^{+++}
Jordan	0.537	0.040	-0.219	3.219	8.071	54.89^{+++}
Morocco	0.210	0.040	-0.132	5.471	14.43	56.89^{+++}
Turkey	0.337	0.033	-0.428	4.219	8.071	54.09^{+++}
Tunisia	0.128	0.093	-0.598	5.344	8.071	54.09^{+++}

Table 3 highlights the factors that significantly contribute to explaining financial integration. They are obtained by estimating the whole system (2). Inflation, and the current account have a negative impact on financial integration, while, the yied spread, the volatility of exchange rates and the regional dividend yield have a posite impact on financial integration.

Inflation is significant at 5% level. This result confirms that higher inflation has a negative effect on the level of financial integration. Boyd et *al.* (2001) argue that high rates of inflation exacerbate financial market frictions, interfere with the efficiency of financial system. Indeed, inflation reduces the real value of returns on assets from one period to another. Therefore, it can be discouraging for investors, even if the market in which they invest displays high yields. Again, an important inflation differential between two financial centers can weaken their degree of financial integration.

Table 3 also shows that the coefficients of exchange rates' volatility are statistically different from zero and positive. On a theoretical level, the parity of uncovered interest rate implies that economic agents arbitrate between domestic and foreign assets of the same maturity, based on exchange rate expectations. Furthermore, these exchange rate expectations contribute significantly to the dynamics of exchange rate adjustment. In this vein, Bodart and Reding (1999) and Bracker et *al.* (1999) demonstrate that the correlations of financial markets are widely affected by the dynamics of exchange rates. Besides, Table 3 puts in evidence the non-significance of short and long-term interest rates. Such findings corroborate those of Bekaert et *al.* (2005) as well as Hardouvelis et *al.* (2006) that there is no relationship between increased financial integration and changes in interest rates on stock markets.

Table 3 also reports that yield spread has a positive effect on the degree of intra-regional integration. The positive sign reveals that rise in interest rates increases the level of intra-regional integration. Such a result disagrees with Arouri (2006) one. Arouri (2006) previously underlines that this variable is not significant for all emerging countries in the study of integration with the global market.

As for the current account deficit, it is statistically significant and has a negative effect on financial integration. Our results contradict those of Bhattacharya and Daouk (2002) who find that this factor has a positive effect on financial integration.

Similarly, coefficients of dividend yields of the regional market are significant at conventional levels of risk; what emphasizes their noteworthy impact on financial integration. Bekaert and Harvey (2000) have already shown that dividend yield is a predictor for equity integration in emerging markets. It is also an important factor in pricing the international equity risk premium (see Fama and French, 1998), and a popular instrument in international conditional asset pricing model (see Ferson and Harvey, 1994, 1999; and Bekaert and Harvey, 1995). Bekaert and Harvey (2000) have already shown that dividend yield is a predictor for equity integration in emerging markets. Therefore, if dividend yield differential is significant, we can expect more segmentation.

Table 3 finally stresses the significant and positive influence of economic growth on financial integration. Carrieri et *al.* (2007) argue that GDP is a better approximation to capture the level of economic integration and should lead to greater integration of capital markets.

Table 3 – Potential variables of financial integration

	Mean	Std. dev.	α_0	α_1
Trade openness			-0.154	-0.291
	0.520	0.100	(0.753)	(-0.425)
Market development			-0.122	0.488
	0.004	0.001	(-0.550)	(0.284)
Industrial production			0.027	-0.0212
	0.280	0.021	(0.217)	(-0.459)
Inflation			-0.642**	-0.320**
	0.040	0.012	(-0.409)	(0.017)
Short term interest rates			-0.139	1.822
	0.002	0.007	(-0.417)	(1.728)
Yield spread			0.991***	0.900***
	0.280	0.021	(0.474)	(0.0001)
Long term interest rates			0.200	0.200
	0.002	0.070	(6.255)	(1.700)
Volatility of exchange rates			0.675***	0.568***
	1.755	1.012	(-0.064)	(0.111)
Economic growth			-0.242	17.947***
	2.599	0.672	(-0.335)	(0.792)
Current account deficit	2.240	10.04	-0.734***	0.025***
			(-0.058)	(0.005)
Local market returns	0.679	0.896	0.216	-0.397
			(0.309)	(1.449)
Regional market returns	0.122	0.677	-0.194	-2.495
			(-0.103)	-(2.443)
National dividend yield	0.324	0.789	0.216	-0.937
			(0.698)	(-0.646)
Regional dividend yield	6.373	6.373	0.212***	0.187***
			(0.062)	(0.061)
Word interest rate	3.980	3.980	1.659	0.282
			(-1.79)	(1.646)
Global market returns	0.0398	0.039	-0.0344	0.0547
			(-0.0855)	(0.634)
International dividend yield	0.897	0.897	-2.504	-0.607
			(-2.047)	-(1.99)
G7 industrial production	1.897	0.101	2.704	1.508
			(1.778)	-(1.521)
Difference in growth rates	2.564	0.231	-4.34	0.981
			(-3.82)	(0.920)
Difference in Dividend Yield	0.364	0.112	-0.089	0.659
			(-0.857)	(0.721)

Notes: *, **, and *** indicate that the coefficients are significant at the 10%, 5%, and 1% levels respectively. Numbers in parenthesis are the associated standard deviations.

5. Conclusion

A conditional version of the International Capital Asset Pricing Model (ICAPM) has been implemented to investigate the regional integration's determinants of five stock markets in the MENA region. The study highlights that number and nature of main determinants of regional integration markedly vary with the proxy used to assess the exchange rate risk; what may partly account for divergence in previous studies. In the meanwhile, inflation, volatility of exchange rates, yield spread, current account deficit, dividend yield and economic growth factors are identified as the key factors that drive regional financial integration in the MENA region.

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