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Sectoral vs. Country diversification benefits in MENA area

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Abstract —In this paper, we study the dynamics of gains from sectoral diversification versus geographic diversification over the period of January 2006 to June 2012, and the economic sources that could be behind the potential changes in those gains. The ADCC (Asymetric generalized Dynamic Conditional Correlation) model developped by Capiello et al (2006) is used to estimate the conditional correlation and volatility of weekly country, sector and country/sector returns indexes over 2006-2012 period. This model offers a flexible specification for the conditional correlation process that is responsible for the proper estimation of broadly diversified portfolios. The estimation results point to an increase in the average correlation between country indexes, but at the same time there is an important decline in the correlation within sector indexes. We also found that the volatility in the sector indexes has decreased in comparison with the volatility in the country indexes.

***Keywords*—portfolio diversification, asymmetric general conditional correlation, sectoral benefits, MENA area,sectoral diversification.**

I. INTRODUCTION

Usually, gains of diversification are higher when investors diversify their portfolio across countries, than when they diversify their portfolio accross economic sector. In this contex, many authors such as Roll and Arshanapalli (1992), Doukas and Lang (1997), Griffin and Karolyi (1998), and Rouwenhorst (1999) suggest that country diversification are much more important than industry diversification. Other authors, Lessard (1976),Errunza and Padmanallan (1988), Grinold, Rudd and Stefek (1989), Drummen and Zimmermann (1992), Arnold (2001) and Eiling and al (2010), all note that country risks are much more important than industry risks. They concluded that higher economic and financial integration should have decreased cross-country diversification benefits between countries.

Diversification benefits stem from the imperfect correlation between asset returns. In this paper, we identify the role of time-variation and asymetries in return correlation in order to estimate the relative importance of country vs. sector diversification benefits. This paper re-examines the question of country-vs-sector diversification benefits in the MENA area using the Asymmetric generalized Dynamic Conditional Correlation (AG-DCC) model of Engle (2002) that corrects asymmetries and time-varying.

The structure of the paper is as follows: In the first section, we review the literature of country vs. sector diversification benefits, and we motivate our modeling strategy. In section 3, we present data and methodology, in the next section we describe the ADCC model. In the following section, we present and discuss the estimation results, we evaluate the variation of sector and goegraphic diversification gains and we discuss the impact of time-variation and asymmetrics on diversification returns. The last section is reserved for the conclusion.

II. MOTIVATION

There is a vast literature on the gains resulting from adopting a country vs.sector portfolio diversification strategy: Arnold (2001) extended the Rouwenhorst datasets (1999) and included additional information to show that sector diversification is more beneficial. Baca, Garbe and Weiss (2000) have shown that the benefits of geographic diversification are equal to the benefits of sectoral diversification. Cavaglia et al (2000) found that the benefits of sectoral diversification of 1997 are the most important ones.

Other authors such as Iskov and Sonney (2003) tested the importance of sectoral diversification during the period 1997-2000, and they conclued that the benefits of diversification have become increasingly relevant since 2000. Brooks and Del Negro (2004) emphasized the importance of sectoraldiversication gains.

To summarize, the literature has traditionally pointed to important country factors in stock returns which brough to low cross-country correlations and important benefits from cross-country diversification strategies. Since 1999 and the introduction of the Euro, the evidence has been mixed. Some papers point to an increase of importance of sector diversification. Others point to importance of geographic diversification and conclude that the effect of sector diversification is temporary rather than permanent. An increase in the correlation between asset returns during periods of high volatility or negative returns implies that diversification gains may disappear. Therefore, it is important to evaluate the effect of correlation on diversification gains of a negative trend or increased volatility.

In this paper, we use the conditional correlation between index returns to estimate diversification benefits associated with specific investment strategy. The questions we concentrate on are the decision of the investor's portfolio whether it is more beneficial for him to diversify cross-sector and not cross-country within the MENA area or in the US market.

III. DATA AND METHODOLOGY

To access the benefits of international portfolio diversification from a variety of countries and sectors, we measure the correlation between market returns in 8 countries (Maroc, Israël, Saudi Arabia, United Arab Emirates, Turkey, Tunisia, Egypt and Jordan) split into 11 sectors. The list of sectors is as follow: sector of agriculture, sector of food industries, sector of Building, banking and financial services, hotel and tourism, general Industries, Estate, telecommunication and technology, transport and Energie and Utilitie.

More specifically, we consider three datasets: market returns for 8 countries wordwide, 11 sector indexes wordwide, and 11 sector indexes for MENA area. Sectoral breakdown is performed according to Data stream level 3. We include country / sector indexes in order to identify specific sector effects and their contribution to the overal results.

The sample consists of continuously compounded USA currency returns measured as log-differences in index prices over 337 weeks from January 2006 to June 2012. Returns were expressed in USD terms in order to make results more easily comparable with the rest of countries.

IV. EMPIRICAL MODEL

The model of Cappiello, Engle and Sheppard (2006) is used to estimate the correlation and volatility of the indices of market returns of 8 countries in the MENA region, the US market and 11 sectors for each country

The covariance matrix H_t can be decomposed as follows:

$$\boldsymbol{H_t = D_t R_t D_t}$$

Where D_t is the KxK diagonal matrix of time-varying standard deviations from univariate GARCH models.

Firstly four GARCH models for r_{it} are estimated:

$$\boldsymbol{h_{it} = \omega_i + \alpha_i r^2_{it-1} + \beta_i h_{it-1}}$$

We can use likelihood ratio tests to find the model that fits best the correlation process.

Equation 1 is the standard scalar DCC(Engle, 2002) model :

$$\boldsymbol{Q_t = (1 - a - b)\bar{Q} + a\varepsilon_{t-1}\varepsilon'_{t-1} + bQ_{t-1}} \quad (1)$$

$$\boldsymbol{P_t = Q_t^{*-1} Q_t Q_t^{*-1}}$$

Where$\bar{P} = E[\varepsilon_t \varepsilon_t^{'}]$, and a et b are scalars such that a + b < 1. $Q_t^* = \left[q^*_{ii,t}\right] = \left[\sqrt{q_{ii,t}}\right]$is a diagonal matrix with the square root of the diagonal element of $\boldsymbol{Q_t}$ on its i^{th} diagonal position. However, this model does not allow for asset-specific news and smoothing parameters or asymmetries. Cappiello, Engle, & Sheppard (2006) proposed the asymetric generalized DCC (AG-DCC) that allows for series-specific news impact and smoothing parameters and permits conditional asymmetries in correlation dynamics. The Capiello, Engle and Sheppard (2006) model is presented as follow:

$$\boldsymbol{Q_t = (\bar{P} - A'\bar{P}A - B'\bar{P}B - G'\bar{N}G) + A'\varepsilon_{t-1}\varepsilon'_{t-1}A + G'n_{t-1}n'_{t-1}G + B'Q_{t-1}B} \quad (2)$$

Where A, B, and G are $k \times k$ parameter matrices, $n_t = I[\varepsilon_t < 0] o \varepsilon_t (I[.] isak \times 1$ indicator function which takes on value 1 if the argument is true and 0 otherwise and $\bar{N} = E[n_t n'_t]$. The asymmetric DCC (A-DCC) is obtained as a special case of the AG-DCC if the matrices A, B, and G are replaced by scalars. Similarly, the generalized DCC (G-DCC) is a special case of the AG-DCC when G = 0. For $\boldsymbol{\bar{P}}$and $\boldsymbol{\bar{N}}$, expectations are infeasible

and are replaced with sample analogues, $T^{-1}\sum_{t=1}^{T}\boldsymbol{\varepsilon_t}\boldsymbol{\varepsilon_t'}$ and $T^{-1}\sum_{t=1}^{T}\boldsymbol{n_t}\boldsymbol{n_t'}$, respectively.

The scalar A-DCC model is defined as follow:

$$\boldsymbol{Q_t} = (\overline{\boldsymbol{P}} - \boldsymbol{a^2}\overline{\boldsymbol{P}} - \boldsymbol{b^2}\overline{\boldsymbol{P}} - \boldsymbol{g^2}\overline{\boldsymbol{N}}) + \boldsymbol{a^2}\boldsymbol{\varepsilon_{t-1}}\boldsymbol{\varepsilon'_{t-1}} + \boldsymbol{g^2}\boldsymbol{n_{t-1}}\boldsymbol{n'}_{t-1} + \boldsymbol{b^2}\boldsymbol{Q_{t-1}}, \quad (3)$$

"a" sufficient condition for Qt to be positive definite is that the matrix in parentheses is positive semi-definite. A necessary and sufficient condition for this to hold is: $a^2 + b^2 + \delta g^2 < 1$, Where δ = maximum eigenvalue$\left[\bar{P}^{-1/2}\bar{N}\bar{P}^{-1/2}\right]^5$.

V. RESULTS AND INTERPRETATIONS

We have estimated four GARCH model specifications (DCC, ADCC, GDDCC and AGDDCC). The model that fits best the correlation process is the ADCC model. Results showed significant effect of ARCH (α) effect which indicates that the conditional volatility of stock market returns depends on past shocks. The persistence of the conditional variance of studied series is also proved. The effect of asymmetry is very low for MENA market indexes, and most important for the sector model.

Table 1 presents unconditional correlation of the US market with MENA region and correlation coefficients between the markets in the MENA region. We note that the markets of MENA region are not highly correlated with the US market. This result confirms the idea of the interdependence of these markets. It is observed that the highest correlation with the US market is that of Jordan : 6.10% and the lowest correlation coefficient is that of Israel : 2.54%. The correlation coefficients between the returns of stock market indices of MENA markets are more important than the correlation coefficients of the same markets with the United States. The highest correlation coefficient is attributed to the stock market of Turkey with Israel was 49.24% and the lowest coefficient is marked by Morocco with Saudi Arabia.However, the MENA markets have low dependency relationship both between themselves and with the US market.

This independence between the American market and the markets of the MENA confirms the segmentation of these between themselves and with the United States market. Therefore, investors can achieve significant gains through international diversification on these markets.

TABLE I
CORRELATION MATRIX of RETURNS STOCK MARKET INDICES in THE MENA REGION

Pays	Maroc	Israel	Egypte	A.Saoudite	Turquie	Tunisie	Jordanie	E. A Unis	USA
Maroc	1.000								
Israel	0.13	1.000							
Egypte	0.293	0.189	1.000						
Arabie Saoudite	0.061	0.155	0.183	1.000					
Turquie	0.167	0.492	0.285	0.219	1.000				
Tunisie	0.152	0.109	0.07	0.095	0.107	1.000			
Jordanie	0.144	0.131	0.21	0.138	0.132	0.178	1.000		
E.Arabe sUnis	0.124	0.24	0.294	0.274	0.24	0.099	0.278	1.000	
USA	0.035	0.025	0.041	0.036	0.045	0.059	0.061	0.026	1.000

TABLE 2
CORRELATION MATRIX of RETURNS SECTORS INDICES in THE MENA REGION

	AG	AS	IA	BA	SB	HT	IG	IM	TT	TR	EN
Agriculture	1.000										
Assurance	0.002	1.000									
Industries alimentaires	0.048	0.191	1.000								
Bâtiments	0.018	0.013	0.209	1.000							
Service bancaire	0.014	0.026	0.356	0.383	1.000						
Hôtel et Tourisme	0.019	0.014	0.129	0.055	0.277	1.000					
Industries générales	0.019	0.036	0.355	0.03	0.257	0.035	1.000				
Immobilier	0.017	-0.052	0.268	0.277	0.298	0.028	0.393	1.000			
Télécommunication et technologie	0.014	0.031	0.188	0.316	0.491	0.02	0.321	0.024	1.000		
Transport	0.02	0.291	0.288	0.376	0.278	0.017	0.364	-0.036	0.04	1.000	
Energie et Utilitie	0.012	0.040	0.011	0.476	0.302	0.018	0.269	0.021	0.032	0.019	1.000

Table 2 presents unconditional correlation of 11 sectors of the MENA region. If we compare Table 2 with Table 1, we see that the sector indices correlation coefficients arelower than those of the MENA markets. It is found that the highest correlation is the one between the banking sector with the telecommunication industry andtechnology; it is of the order of 49.12%. The lowest coefficient is the one that connects the Real Estate sector with the transport sector is (-3.61%).

TABLE 3

THE ESTIMATES of THE ADCC MODEL of THE COUNTRIESINDICES

	ParametersGarch			ADCC		
	ω	α	β	a	b	g
Maroc	0,35	0,17	0,77	0,00	0,76	0,00
	(0.151)	(0.052)	(0.059)	(0.103)	(0.045)	(0.000)
ISRAEL	0,73	0,15	0,76	0,00	0,75	0,00
	(-0,34)	(-0,05)	(-0,08)	(-0,10)	(-0,05)	(0,00)
EGYPTE	0,53	0,21	0,78	0,19	0,38	0,00
	(-0,27)	(-0,06)	(-0,04)	(-0,13)	(-0,89)	(0,00)
ARABIE SAOUDITE	0,16	0,23	0,80	0,00	0,75	0,00
	(-0,12)	(-0,05)	(-0,03)	(-0,18)	(-0,06)	(0,00)
TURQUIE	3,64	0,18	0,65	0,00	0,64	0,00
	(-1,62)	(-0,06)	(-0,11)	(-0,19)	(-0,13)	(0,00)
TUNISIE	1,11	0,33	0,44	0,00	0,71	0,00
	(-0,49)	(-0,17)	(-0,20)	(-0,11)	(-0,06)	(0,00)
JORDANIE	0,24	0,24	0,73	-0,08	0,73	0,00
	(-0,10)	(-0,07)	(-0,06)	(-0,30)	(-1,81)	(0,00)
EMIRATES ARABES	1,08	0,33	0,65	-0,24	0,00	0,00
	(-0,40)	(-0,07)	(-0,06)	(-0,14)	(-1,10)	(0,00)
USA	0,95	0,14	0,76	0,00	0,74	0,00
	(-0,46)	(-0,04)	(-0,08)	(-0,12)	(-0,05)	(0,00)

The table 3 presents the estimated coefficients for the country. The left part of the table shows the estimated parameters of the model GARCH while the right side shows the settings for conditional correlations dynamic. The estimated parameters of the models GARCH are statistically significant.Indeed, there are significant differences in the Persistence estimated at 1 - α-β and the size of ω / (1 - α-β) in the processes of volatility across the different countries.

It notes that the persistence (α) is low and statistically significant for all the countries of the MENA region and also for the American market. Where the conditional volatility of the yields of the stock markets depends on past shocks, the sum of α and β is very close to the unit for all markets. This explains the importance of the persistence of the conditional variance of the series studied.The conditional volatility resulting from the models GARCH univariate is used to normalize theseries of performance. These are the input for the estimation of the models presented in the previous section.

The right side of the table 3 displays the settings of conditional correlations dynamics of the ADCC model (asymmetric dynamic conditional correlation).

TABLE 4

THE ESTIMATES of THE ADCC MODEL of THE SECTORS INDICES

	ParametersGarch			ADCC		
	ω	α	β	a	b	g
Agriculture	438.731	0.370	-0.077	0.093	0.926	0.400
	(-0.014)	(0.000)	(0.000)	(-0.058)	(-0.054)	(-0.169)
Insurance	21612.642	0.318	-0.082	-0.007	0.675	0.000
	(-5891.009)	(-0.099)	(-0.185)	(0.000)	(0.000)	(0.000)
Food industries	2.960	0.301	0.371	-0.322	0.000	0.000
	(-0.714)	(-0.107)	(-0.120)	(-0.176)	(-0.494)	(0.000)
Buildings	1.586	0.290	0.574	0.000	0.770	0.000
	(-0.571)	(-0.078)	(-0.095)	(-0.158)	(-0.045)	(0.000)
Banking and Financial Service	0.948	0.646	0.418	0.000	0.976	0.134
	(-0.309)	(-0.183)	(-0.085)	(-0.100)	(-0.054)	(0.000)
Hotel and Tourism	29034.921	0.298	-0.363	0.000	0.703	0.000
	(-6081.392)	(-0.093)	(-0.164)	(-0.128)	(-0.060)	(-0.001)
General industries	2.169	0.250	0.535	0.000	0.735	0.000
	(-0.751)	(-0.078)	(-0.118)	(-0.242)	(-0.117)	(-0.001)
Real estate	34519.553	0.166	-0.248	-0.068	0.647	0.000
	(-11649.340)	(-0.069)	(-0.324)	(0.000)	(0.000)	(0.000)
Telecommunications and Technology	13116.650	0.412	-0.016	-0.429	0.000	-0.003
	(-1951.065)	(-0.102)	(-0.070)	(-0.114)	(-0.335)	(-0.001)
Transport	1.324	0.365	0.531	0.287	0.000	0.000
	(-0.447)	(-0.085)	(-0.086)	(-0.137)	(-1.040)	(0.000)
Energy and Utilities	6.569	-0.008	0.598	0.000	0.869	0.000
	(-0.876)	(-0.01)	(-0.027)	(-0.10)	(-0.02)	(0.000)

The settings GARCH are the estimates Garchunivariate used to standardize the performance data
The ADCC settings match the model asymmetric DCC
The differences types are shown in parentheses

The table 4 presents the estimated coefficients for the sectors. The left part of the table shows the estimated parameters of the model GARCH while the right part is the settings of the correlations dynamic conditional. The coefficients a and B contained in the right part of the table 3 and 4 correspond to the elements of the diagonal of the matrix, they are significantly different from 0. The effect of the asymmetry which is measured by the coefficients g is very low for the model related to stock indices of the

MENA region and more important for the model relating to sectoral indices. The ADCC is the most appropriate model in our sample. The selection of the model and the choice of the order can be done by the likelihood ratio test.

The correlation is strongly sensitive to negative shocks to positive shocks especially that the analysis period is marked by the presence of the financial crisis of 2008-2009. Indeed, when one of the markets in this region is affected by the negative effects of the crisis, the correlation between the markets in this area will increase considerably. This affects the decisions of investors vis-a-vis the geographical diversification. Our results clearly show that a sectoral diversification is more advantageous than the geographic diversification for the countries of the MENA region of our sample. Face to such a finding, the investors in various countries could be brought to reorient their diversification strategies, in order to take advantage of new opportunities by taking advantage of possible disparities and distortions between sectors of activity.

As for the conditional correlation, figure 1 show that the average conditional correlation between the 8 country index returns has clearly increased during the last five years(see figure1). The average conditional correlation increases from a value around -0.2 in 2006 to around 0.3 in 2011. Moreover, fluctuations are increasingly intensified especially since the correlation in the ADCC model is relatively less persistent.Figure 1 show also that sector correlations decreased during the same period and that stock markets are more correlated than sectors.

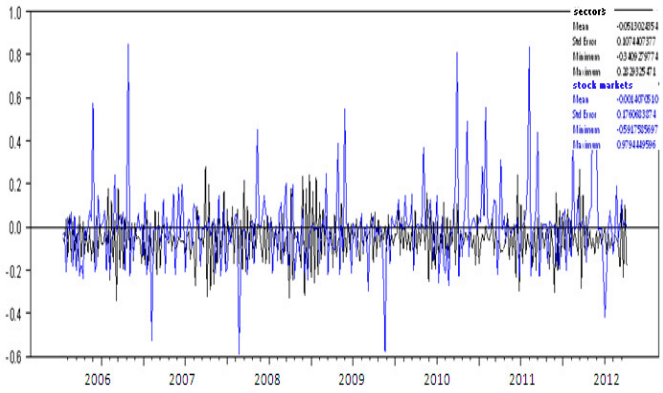

Fig 3 Conditional correlation both between mena market and Mena sectors

VI. SUMMARY AND CONCLUSION

The correlation is strongly sensitive to negative shocks to positive shocks especially that the analysis period is marked by the presence of the financial crisis of 2008-2009. Indeed, when one of the markets in this region is affected by the negative effects of the crisis, the correlation between the markets in this area will increase considerably. This affects the decisions of investors vis-a-vis the geographical diversification.

When the ADCC model is applied to country and sector portfolio, we find that correlations between countries have increased strongly while the correlation between sector indexes has shown a remarkable decrease. While correlations between country and sector indexes have moved in opposite directions, for both type of indexes we note a strong increase in conditional volatility. Moreover, the increase of sector indexes is stronger than the increase of country indexes. Relatively higher country correlation was less of a problem because the increase in country volatility was relatively smaller. So, growth volatility sectors are offset by the decrease in average sector correlations.

Our results clearly show that a sectoral diversification is more advantageous than the geographic diversification for the countries of the MENA region of our sample. Face to such a finding, the investors in various countries could be brought to reorient their diversification strategies, in order to take advantage of new opportunities by taking advantage of possible disparities and distortions between sectors of activity.

We relate changes in the correlation structure of country and industry equity returns to the real and financial sectors of country economies. We note that the reduction in gains from geographic diversification is due partly to financial convergence and the economic integration

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