DIVERSIFICATION PROSPECTS IN THE MIDDLE EAST

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Abstract

Given the historic reliance of the Middle East upon oil, the region is frequently omitted from literature regarding portfolio diversification. This study aims to quantify the extent to which this oil-reliance still remains and consequently to provide an assessment of the regional opportunities now available to a Euro-based investor. In general, this paper finds significant sensitivity of national equity-index returns to oil price movements pre-2004 in line with expectation. Since this date, however, economic diversification has grown rapidly throughout much of the region. Portfolio diversification analysis supports these results, with clear benefits of involvement in these markets being found under both a modern portfolio theory and a Value-at-Risk approach. In light of this work, investors are strongly recommended to consider the opportunities available to them in the Middle East conditional upon their diligence in asset analysis. This caveat results from the detection of a 'Peso Problem' in a number of the equity-indices sampled which is shown to create excess long-run portfolio risk if ignored. This study provides a framework for overcoming such problems and tests this for robustness given the recent political and market turmoil in the region. These results are also of value to Middle Eastern policy makers, with sector-level analysis included for their reference.

(I) INTRODUCTION

Since its inception five decades ago, much literature has studied modern portfolio theory and the idea that diversification across various regions can lower the risk of an investment basket for a given return. Such work, notably Shawky et al. (1997) and Solnik (2000), often focusses upon emerging markets given their reduced integration within the global business cycle. Capital movements imply these benefits are pronounced, with Goetzamann and Jorion (1999) finding net-private-inflows to these markets doubling six times 1990-1996. Historically, however, the Middle East has seldom been part of such analysis owing to its great dependence upon oil. As claims of regional diversification grow, so too does a belief that the area should now become part of such considerations.

It appears appropriate that the region has previously been excluded from diversification studies as economic reliance upon oil implies few risk-reduction benefits of financial involvement. The International Monetary Fund (IMF) through Okogu (2003) finds that since 1980 oil revenue often comprises 60% of total regional income, sometimes with upwards of 80% of total exports being oil-derived. In the past two decades state-officials have been understandably keen to promote and encourage growth in economic diversity to dampen the impact the commodity's volatile price has upon domestic output. Focus is frequently directed at the falling level of oil-derived GDP as a percentage of the total. The Organisation of Petroleum Exporting Countries through Choudhury and Al-Sahlawi (2000) cite a 50% decline in this statistic for Saudi Arabia 1980-1996. Similar figures appear throughout the region, but most fail to address whether wealth derived from oil remains the real economic life-blood. If, however, there truly have been significant declines in internal oil-dependence, this suggests a growing importance of these markets for portfolio diversification.

The aim of this work is therefore clear; to determine whether Middle Eastern economies have moved away from heavy dependence on oil and to what extent they now represent viable opportunities for international portfolio diversification. Through taking a panel of Middle Eastern countries, the changing impact of oil over the past twelve years can be calculated at both index and industry level. This is in essence an argument in internal diversification where finding equity returns have a continuing significant reliance on oil demonstrates a definite lack thereof. Following this, it is determined whether the region now presents opportunities to international investors for portfolio diversification. This is done through the construction of optimal international portfolios from a combination of Euro and Middle Eastern equity indices using Markowitz's mean-variance

efficient asset allocation method. These portfolios are then compared using a variety of performance tests to analyse the efficiency of each investment basket.

To the best knowledge of the author, this paper presents the first study to bring together arguments in internal and international diversification for a panel of Middle Eastern countries. In addition, no other work has been directed solely at this region contrasting a panel of net-exporters and net-importers of oil. For the investment community, the internal diversification study hopes to highlight both the current and previous oil-price-risk inherent in these markets. The international diversification analysis is possibly more valuable for this group as it showcases the variety of opportunities available for maximising portfolio efficiency or for targeting specific investment attributes across the region. Of equal importance is discussion regarding an observed 'Peso Problem' as well as demonstration of its impact upon long-run profitability if ignored. A second group to whom this work appears of value is Middle Eastern policy makers. It is almost certain that these nations are not yet independent of oil-price-risk. This analysis will provide a reference as to nations/industries where ongoing diversification efforts ought to be placed. It can also quantify the risk to the entire economy both from policy imposed upon domestic oil companies and continued exposure to global price movements. For the academic community this paper hopes to demonstrate the link between the hitherto separate areas of study of oil-equity relationships and internal diversification.

(II) LITERATURE REVIEW

Markowitz (1952) pioneered modern portfolio theory suggesting investors should select baskets of assets based on their risk-reward characteristics rather than individually assessing securities. Under this framework, the gains from international portfolio diversification are inversely related to the correlation of the individual securities' returns. Investors therefore benefit from portfolio diversification as through investing across a wide range of uncorrelated assets they can produce a more efficient basket of securities.

Given their relative separation from the global business cycle, emerging markets theoretically represent some of the greatest portfolio diversification prospects. Eun and Resnick (1984), Wheatly (1988), Meric and Meric (1989) Divecha et al. (1992), Michaud et al. (1996) and Gilmore and McManus (1992) all demonstrate significant diversification prospects across various samples of emerging equity markets. Middle Eastern indices, however, make up an immaterial proportion of

this work given historical reliance of the region upon oil implying a lack of economic diversification. Two papers draw on regional changes in the past two decades and therefore provide commentary on the benefits these countries can now provide for an investor. Lagoarde-Segot and Lucey (2007) study the Middle East and North African area finding evidence of diversification benefits for a U.S. investor in the majority of these. Equally Olusi and Abdul-Majid (2008) find greater efficiency in a portfolio mixing Middle Eastern with Eurozone securities as opposed to constraining investment to either area. Both papers, however, focus much of their work upon frontier markets such as Morocco and fail to sample from net-oil-exporter nations. Furthermore, they neglect entirely to consider the extent of internal economic diversification.

Internal diversification does appear though to be an important theoretical factor in concluding whether these nations can play a significant role in international diversification. Bley (2007) suggests the high internal oil-reliance of the Middle East means that it is unlikely to provide as strong prospects as other emerging market areas to a Euro-investor. Regarding internal diversification, the literature consensus implies some regional development but with oil still taking a prominent role. Fasano and Iqbal (2003) find oil revenue as a percentage of total government income 1998-2002 to average over 65% for the majority of countries sampled with some, such as Oman and Saudi Arabia, over 75%. These conclusions are backed by the work of Cleron (1978) and Barker (1982) who demonstrate an, "inextricable dependence of the non-oil on the oil sector" within Saudia Arabia. Choudhury and Al-Sahlawi (2000) conclude in contrast to this, taking a more recent and longer time horizon. They find not only a decreasing influence of the energy sector upon Saudi Arabian GDP 1984-1996 but also a fall of over 37 percentage points in the extent to which other industry returns are oil-reliant. These papers, however, do not wholly oppose one another as the conclusions of the latter do not suggest complete independence from oil but more demonstrate increasing self-reliance of the non-oil sector. Similar conclusions are echoed throughout the region, for example in Kuwait by Al-Kawaz (2008). Conversely it is interesting to note that Mussa (2000) does not class any Middle Eastern net-exporter of oil as economically diversified when using an IMF definition whereby oil export revenues constitute less than 10% of the total.

One area which appears relatively understudied but still important in diversification arguments is the extent to which each nation relies upon intra-regional investment. The Arab Investment Guarantee Company (2009) finds that since 1990 Kuwait and Saudi Arabia have been the largest intra-regional capital exporters concluding the majority of liquid regional capital is oil-derived. Bolbol and Fatheldin (2005) study the extent to which nations rely upon intra-regional funding,

finding Jordan receives the highest proportion of regional relative to global investment while Kuwait source all foreign investment from outside the Middle East. Averaged across the region this ratio declined from 50.4% to 24.3% 1999-2009. The extension of this is that as net-importer nations rely less upon regional capital flows, their index returns similarly become less reliant on oil.

Literature studying equity returns' oil-price-sensitivity is fairly common but it rarely makes explicit the implications for economic diversification. Hamilton (1983) finds a significantly damaging impact of rising oil prices upon global growth, a phenomenon verified by Jones et al. (2004) and Gisser and Goodwin (1986). The IMF through Mussa (2000) goes further, finding that an increase of $5 in the 2001 price of oil would suppress aggregate global GDP growth by 0.25%. The International Energy Agency (2004) extended this, finding a "sustained $10 increase in oil prices...would result in the OECD...losing 0.4% of GDP". Jones and Kaul (1996) link this relationship to equity movements, theorising oil price changes impact real cash flow values and consequentially equity prices. They find a negative relationship between equity returns and oil price for the U.S., Canada, U.K. and Japan although with only an insignificant effect for the latter two. Basher and Sadorsky (2006) and Bhar and Nikolova (2009) sample instead from emerging markets. Both find significant impact of oil returns upon industries in which the commodity represents a significant input (output) such as transport (mining) companies. Neither work draws a material portion of data from the Middle East thus preventing conclusions being extended to this region. It is this diverse theoretical framework which provides the motivation and support for the current study.

(III) DATA

The data used within this work consists of dollar-denominated weekly closing price series between 08/12/1998 and 08/12/2010 unless otherwise indicated. The Middle Eastern indices (Saudi Arabia, Kuwait, Dubai, Israel, Jordan, Turkey) are reported by each national exchange. The Standard and Poor's Euro Index (Euro S&P) is used to represent the Eurozone market as it is the benchmark equity index throughout the majority of Europe. The Euro S&P is a free-float value-weighted index covering 70% of total European capitalisation. The Morgan Stanley Capital International (MSCI) World Index is used for world market returns while oil returns are calculated using West Texas Intermediate (WTI) futures. Globally this is the most traded commodities contract and is used as a common benchmark to set other oil related prices. The risk-free rate is the EURIBOR 12 month rate as at 09/12/2010, this being the day following data cut-off when all portfolios are formed. All data is obtained from Datastream.

Table (1) provides summary statistics of the indices' returns' data. The Euro S&P has the lowest average weekly return of all markets, however, both the Kuwaiti and Jordanian indices show lower standard deviation (SD). Within the Middle East, Turkey has the highest return and SD. The market return per unit of volatility (Sharpe ratio) is calculated within this figure and shows that all Middle Eastern markets appear far better individual investment prospects than the Eurozone. WTI also performs well in this metric at a 21.1% Eurozone-premium. As an example of the apparent Middle Eastern superiority, Kuwait has a return premium of 93.5% above the Eurozone per unit of volatility. The great majority of literature regarding Middle Eastern investment accepts this as accurate and consequently suggests portfolios dominated by the regional assets[1]. This study instead proposes that such assets are biased by a 'Peso Problem'. Milton Friedman first comments on a similar topic observing that while the 1970s Mexican Peso was pegged to the American Dollar, the former country's interest rate was far higher. Freidman argues that this differential arises because of market expectation of devaluation in the Peso. More generally, Krasker (1980) attributes Peso Problem bias to an ex-ante risk factor causing deviation between the ex-post short-run and the long-run return/risk properties of an asset. Furthermore, Bates (1996) argues this problem can impact distributions' skewness and kurtosis. As a result, potentially all observed distributional moments are biased by an ex-ante factor which underpins the excess return/risk observed in the Middle Eastern indices.

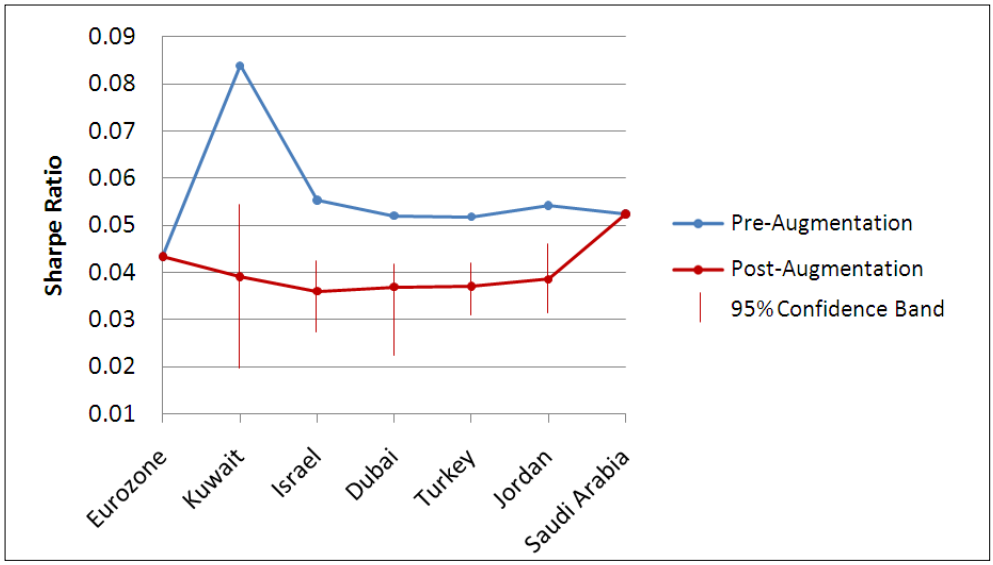
Credit (default) risk is a factor widely studied in connection with asset returns with a strong consensus finding that firms or nations with relatively high default-risk also generate relatively high equity returns. Among these, Fama and French (1993), Ferson and Harvey (1993) and Vassalou and Xing (2004) all provide strong backing to this theory using a variety of multi-factor frameworks to model equity returns' determinants. Bailey and Chung (1995) conclude this effect to be most pronounced when considering emerging market economies. It therefore seems appropriate to view credit-risk as an ex-ante determinant of the observed returns' distributions and so also one which could create the perceived Peso Problem.

To model for any such bias, the observed Middle Eastern returns' data must be exposed to this additional risk factor to generate long-run distribution estimates. The process employed to do this is documented in Appendix (2) with the resultant summary statistics presented in Table (2). A

[1] Literature which directly assesses portfolio opportunities in the Middle East is reasonably scarce however Olusi and Abdul-Majid (2008) and Lagoarde-Segot and Lucey (2007) provide examples of studies in which the extremely high Return/Risk values are assumed inherent properties of the region's equity markets.

comparison of the *default augmented* distributions' Sharpe ratios to the original values is shown in Figure (1). Following this transformation, the Middle Eastern nations appear far less attractive singular investments than under the Peso bias as the long-run estimates produce significantly lower Sharpe ratios than previously. All Middle Eastern nations' Sharpe values now lie below the Eurozone within 16.9% except Saudi Arabia which sits at a premium. Skewness and kurtosis adjustment is discussed below the summary statistics. Figure (2) plots each asset in a Mean-Variance space. From this, Saudi Arabia can be seen to dominate Dubai while the WTI contract dominates Turkey. A dominant country is defined as one exhibiting a greater return for the same or a lower volatility than another. Given this, the dominant assets are predicted to hold greater portfolio weight than their dominated counterparts.

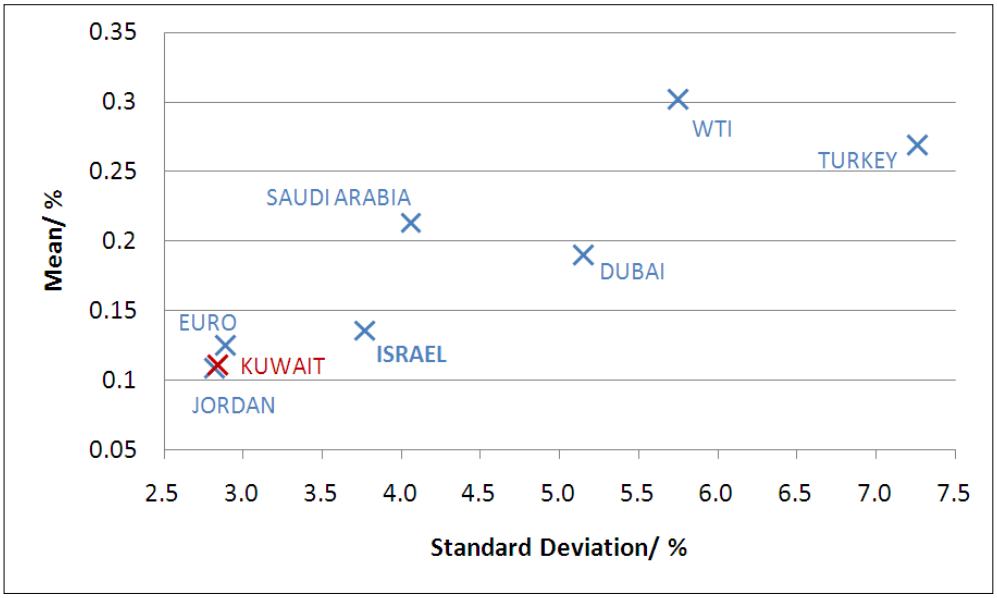
Figure (1): Sharpe Ratio Comparison



Asset correlations are shown within Table (3). From this Israel has by far the highest correlation with the Euro and Oil markets implying it will provide only weak diversification benefits relative to other nations. The highest regional correlations are observed for Saudi Arabia and Kuwait with Dubai. Given this fact and its relatively lower return/risk profile, Dubai is expected to only play a limited role in an all-region portfolio.

Data analysis at sector-level is presented within Appendix (4).

Figure (2): Asset Mean-Variance Space (Post-Augmentation)



(IV) METHODOLOGY

This study begins by employing a market model augmented by the oil price factor. This framework is widely used in oil-price-risk literature such as Nandha and Faff (2007), Chen et al. (1986), Sadorsky (2001) and Al-Mudhaf and Goodwin (1993). Faff and Brailsford (2000) conduct formal tests upon such models in order to verify their fit and suitability. Owing to observed second order serial correlation a GARCH(1,1) error term is used as per Bollerslev (1990) and so the equation is estimated by maximum likelihood with OPG standard errors. This model is applied to the 12 years of data for each equity index and sector with the inclusion of dummy terms active from 2004 to allow a shift in the mean observed oil-reliance. Algebraically;

$$Ind_R = \alpha + \gamma World_R^O + \beta_1 WTI_R + \beta_2 (D \times WTI_R) + \theta D + \epsilon \qquad (1)$$

$Ind_R = Index\ Returns$

$WTI_R = Oil\ Returns$

$World_R^O = Orthogonalised\ MSCI\ Returns = World_R - (\delta_0 + \delta_1 WTI_R)$

With δ_0, δ_1 drawn from: $World_R = \delta_0 + \delta_1 WTI_R$

The two coefficients of greatest interest are β_1 and β_2. While the former estimates the impact of oil returns upon index/sector returns pre-2004, the latter estimates if there is a significantly different sensitivity since this point. A significant positive β_1 therefore suggests higher oil returns were associated with higher equity returns pre-2004 (ie. oil reliance) while a significant and negative coefficient on β_2 indicates that the extent of this influence is diminishing (ie. increasing economic diversification). This framework best addresses the areas of interest whilst also meeting the constraint suggested by Brealey and Myers (2003) of studying periods over 5 years within weekly financial analysis.

Following this, analysis of the portfolio diversification opportunities available to a Euro investor is undertaken. Using Markowitz methodology, portfolios are formed using assets' long-run return and SD values (as calculated through the credit-default augmentation process) as well as the asset correlations. Correlations are calculated over the life of each asset except where the internal diversification results imply an asset short-run correlation with oil. The Markowitz algorithm calculates asset allocations to produce the optimal Sharpe ratio given no investment in the risk-free asset. Portfolios are constructed between the Middle Eastern indices and the Euro S&P for each country ('Euro-Oil-*Country')* as well as one portfolio including all markets ('Euro-Oil-All M.E.'). These are compared to a Euro-Oil case with no investment in the Middle East. Such methodology is extensively covered in existing literature with detailed analysis of the benefits and associated risks. Olusi and Abdul-Majid (2008) provide one such recent example.

The Markowitz framework assumes normal returns' distributions in the portfolio's underlying assets. In the case of many equity markets this does not appear appropriate. The Sharpe ratio therefore may not be a strong measure of portfolio ranking as maximising it does not take into account risk beyond the portfolio SD such as skewness and kurtosis[2]. Considering this effect is especially pertinent as Jondeau and Rockinger (2005) find relatively less developed markets often exhibit significant departure from Markowitz optimality given their greater propensity to non-normal returns.

In order to determine the impact of these additional risk factors on the Markowitz optimal portfolios, Value-at-Risk (VaR) analysis is conducted. Favre and Galeano (2002) provide a

[2] Numerous papers critique the normality assumption of the Markowitz framework including Fama (1965), Rosenberg (1974), Rosenberg and Ohlson (1976), Fuertes et al. (2005). Bekaert et al. (1998) demonstrate the assumption is especially tenuous in the case of emerging markets. The Markowitz framework still prevails in financial literature despite this, a phenomenon most frequently attributed to its "mathematical tractability" (Azzalini and Capitanio (1999)), and as such was chosen for this study.

benchmark for this, but conclude differently as the primary concern of the current study is whether excess risk in the long-run (non-normal) distributions outweigh Markowitz calculated (normally-distributed) diversification benefits. The VaR model utilises the complete observed asset distributions to produce the maximum expected portfolio loss for a given confidence level over a set time-horizon. To form comparable VaR models, all portfolios must target the same rate of return. To do this, the holding in the risk-free asset is adjusted keeping the relative weights of all other assets constant. This VaR framework allows a view to be formed as to whether the additional distributional moments' risks are of such magnitude within the Middle Eastern markets as to nullify the benefits of their inclusion within a given portfolio.

There is a trend within much financial literature to end each study by discussing out-of-sample portfolio performance. Given the short time since data cut-off for this work, little focus will be given to this. Instead, this final analysis will discuss the extent to which the long-run distributions calculated within this work allow for the ongoing political turmoil within the Middle East. As per Crutcher (1974) the most appropriate framework appears a Kolmogorov-Smirnov comparison test. Using this, the estimated long-run distributions are tested against these same distributions inclusive of the index returns observed between December 2010 and April 2011. A rejection of the test statistic here implies that the two distributions are significantly identical and so current market movements fit within the assumptions made and results generated throughout the rest of the work.

(V) RESULTS

Internal Diversification

Please refer to Figure (11) for the full output of the fitted estimates from **(1)**. At index level, all countries showed significant positive sensitivity to the oil price factor before 2004 (β_1). While this contradicts the more general literature which suggests net-importers of the commodity demonstrate negative factor sensitivity, it fits well with the Middle East specific studies which discuss the historical importance of the commodity throughout the region. In line with predictions, Saudi Arabia was the most responsive to a given change in oil price. Kuwait was least sensitive meaning it appears to be less economically reliant on oil than Jordan, Israel and Turkey. The situation for these final three countries agrees with the intra-regional capital flow argument whereby each was predominantly funded pre-2004 by oil-derived capital rather than global investment. Kuwait, however, receives no intra-regional funding and places over 68% of its foreign investment into net-oil-importer nations (Bolbol (2005)). Its capital base therefore seems relatively diverse compared to

much of the region. This unique funding structure could be viewed as encouraging the relatively low sensitivity to oil price changes. This, however, is recognised as a fairly tenuous explanation. In general, however, the central conclusions derived from this coefficient are in line with previous work finding oil price returns to be a significant driving force in all index returns and therefore implying heavy regional economic reliance upon the commodity pre-2004.

The estimated values of coefficient β_2 at index level imply that post-2004 the influence of oil price changes upon equity returns has diminished significantly in Kuwait, Israel and Jordan. In these three countries as well as in Dubai, the oil impact coefficient is now insignificant ($\beta_1 + \beta_2$) suggesting their economies are sufficiently diversified for oil returns to not materially impact equity index returns. This result fits well with the earlier discussion of sector diversification and increasingly diverse investment sources causing index returns' independence from oil. The β_2 estimate for both Saudi Arabia and Turkey was found to be insignificantly different from zero. As such, this study argues that despite the falling sensitivity of GDP to oil returns in Saudi Arabia found by Choudhury and Al-Sahlawi (2000), the nation's equity index returns remain equally reliant upon the commodity now as twelve years ago[3]. Turkey opposes the trend of net-importers' declining sensitivity to oil. While not intuitive, this result does agree with Aktham (2004) and Basher and Sarosky (2006) who find emerging markets to be particularly oil-sensitive owing to their rapid growth and heavy demand. Extending this finding, the recent fall in Turkish equities and rise in sovereign yields to a nine month high should not be attributed solely to the rising cost of oil (Strauss (2011)) given that such movements oppose the nation's true oil-equity relationship.

Sector-level analysis is presented within Appendix (4).

[3] While this conclusion appears counterintuitive market inefficiency could produce such a result. For example, if the investment community perceive the Saudi Arabian economy to be dominated by oil they will react as such regardless of the true underlying fundamentals. There is much literature discussing market efficiency (eg. Fama 1998) however it being tangential to the focus of this study, it is not further discussed.

Figure (3): Index-level estimates fitted from equation (1)

	γ	β_1	β_2	$\beta_1 + \beta_2$ ****	$\beta(Current)$ **
Kuwait	0.257*	0.051*	-0.085*	-0.035	-0.032
	7.03	*2.36*	*-2.39*	*1.43*	*-0.98*
Saudi Arabia	0.383*	0.123*	-0.024		0.116
	9.56	*5.11*	*-0.59*		*5.97*
Dubai* **	0.518*		0.020		0.020
	5.70		*0.45*		*0.45*
Jordan	0.277*	0.074*	-0.109*	-0.035	-0.023
	7.52	*2.85*	*-2.63*	*1.16*	*-0.75*
Turkey	1.207*	0.088*	0.011		0.088
	15.85	*2.17*	*0.13*		*2.20*
Israel	0.854*	0.102*	-0.098*	0.004	0.003
	23.71	*3.95*	*-2.56*	*0.02*	*0.12*

All other coefficients in equation (1) are estimated but are not reported. P-Values are presented in italics.

*Significant at the 5% level

**Where a nation experienced a significant value of b2 this is the oil reliance since 2004. Where they did not, this figure is the long-run equity-oil sensitivity.

***Dubai estimates are fitted post-2004 giventhe insignificant sample available before this

****This value is only calculated where this is a significant value upon the b2 variable

Portfolio Diversification Opportunities

The Markowitz constructed market portfolios are shown within Figure (4). These demonstrate all Middle Eastern nations studied can individually provide an opportunity to diversify a Euro-Oil portfolio and so allow an investor to obtain higher returns per unit of risk exposure.

Figure (4): Optimal Asset Allocations

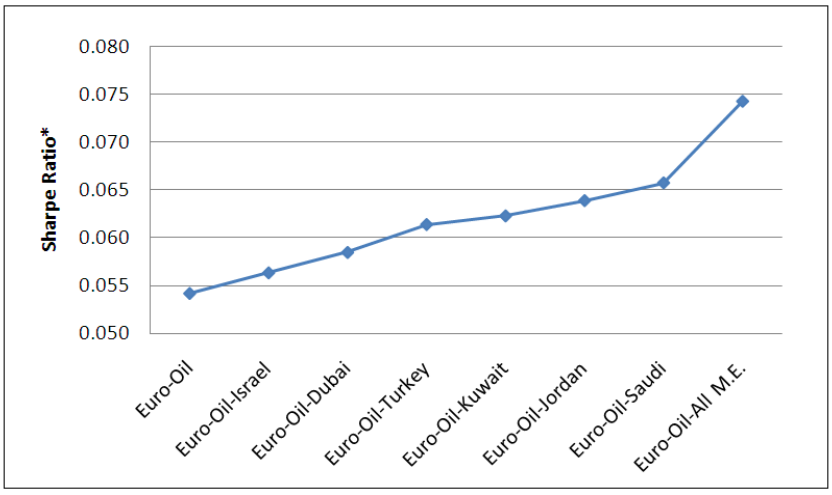
Optimal Portfolios	Mean (%)	SD (%)	Weight (Kuwait)	Weight (Saudi)	Weight (Dubai)	Weight (Jordan)	Weight (Turkey)	Weight (Israel)	Weight (Euro)	Weight (WTI)	Sharpe Ratio*
Euro-Oil	0.20	3.15							0.56	0.44	0.054
Euro-Oil-Kuwait	0.17	2.26	0.39						0.31	0.30	0.062
Euro-Oil-Saudi	0.21	2.75		0.39					0.30	0.31	0.066
Euro-Oil-Dubai	0.20	2.92			0.22				0.42	0.36	0.058
Euro-Oil-Jordan	0.18	2.36				0.38			0.30	0.32	0.064
Euro-Oil-Turkey	0.23	3.27					0.17		0.40	0.43	0.061
Euro-Oil-Israel	0.20	3.03						0.09	0.49	0.42	0.056
Euro-Oil-All M.E.	0.22	2.57	0.12	0.27	0.03	0.12	0.11	0.04	0.04	0.27	0.074

*As calculated using the EURIBOR rate detailed within the data analysis section

The Sharpe ratios of all individual nation portfolios are fairly evenly dispersed at a premium of 4.0-21.2% to the Euro-Oil case. In line with prediction, the Euro-Oil-Israel and Euro-Oil-Dubai portfolios perform poorly owing to the high correlation between these nations and the Euro-Oil

assets. The Euro-Oil-Israel/Turkey portfolios are weighted with 42% and 43% investment in the oil asset respectively which is very similar to the 44% WTI weighting within the Euro-Oil case. This result reflects these nations' high relative correlation with the Eurozone over oil causing the Middle Eastern asset to primarily deduct from the Euro holding. For all other nations, these correlations are more similar causing even declines in the Euro and WTI holdings in their respective portfolios. Figure (5) shows there is no apparent pattern in the benefits of investment in net-importer or net-exporter nations in terms of portfolio diversification therefore highlighting the fact that financial opportunity in the region is not dictated simply by a nation's relationship with oil.

Figure (5): Portfolio Sharpe Ratios



*As calculated using the EURIBOR rate detailed within the data analysis section

The Euro-Oil-All M.E. portfolio performs best using the Sharpe metric. Within this, the three most heavily weighted assets account for 66% of the total investment (WTI-27%, Saudi Arabia-27%, Kuwait-12%). This result fits well with the portfolio splits predicted based upon both the dominant assets observed on the Risk-Reward plane and the asset correlations. It is clear therefore that, under the Markowitz framework, the Middle East represents a strong opportunity to diversify a Euro-Oil portfolio. This supports the conclusions of partial segregation from oil in a region which is assumed by so many as being wholly reliant upon the commodity to drive its economy.

Table (4) shows the adjusted asset weights required for the Middle East inclusive portfolio to target the average return of the Euro-Oil portfolio. Figure (6) presents the 95% and 99% 52 week VaR estimates subsequently formed for each portfolio. At both confidence levels, the Euro-Oil-All M.E. outperforms the Euro-Oil with a lower maximum possible investment loss across all periods. At the 99% level, the Middle East inclusive portfolio lowers the total VaR by an average of 15.0% in the

first six months and 11.6% in the final six months relative to the Euro-Oil case. The five year VaR statistics are also presented in Table (5) demonstrating across all confidence intervals the Euro-Oil-All M.E. outperforms the Euro-Oil portfolio. It is therefore clear that investment in the Middle East has helped to lower the total portfolio risk for a given return and so the region does provide diversification benefits for investors[4]. This therefore further demonstrates that these nations do not merely echo the investment properties of the WTI contract and so should not be ignored for fear of over-exposure to the commodity.

It is interesting to contrast these results with those of Olusi and Abdul-Majid (2008) who generate similar Euro-M.E. portfolios. For the two countries overlapping both studies, portfolio weights on the Middle Eastern nation are 91/94% in the Olusi work as compared to 38/39% in this paper for Jordan/Saudi Arabia respectively[5]. This extremely large difference occurs given the augmentation process by credit-default data undertaken within the current study. The 95% VaR models of the Olusi portfolios are calculated using this study's estimated long-run distributions and shown within Figure (19). These demonstrate that in the long-run, the risk present in the Olusi Middle Eastern portfolios is far greater than a Euro S&P investment targeting the same return (Weekly-0.2%). Within Q1, this danger is not clear as the Middle Eastern portfolios exhibit similar risk levels to their Euro counterpart. However, after this their VaR explodes relative to the Euro portfolio ending the year at premiums of 9/26% in maximum portfolio losses for Saudi Arabia/Jordan respectively. The importance of modeling the Peso Problem therefore becomes apparent as previous literature, omitting this, suggests the formation of portfolios dominated by the Middle Eastern index assets which contain massive excess long-run risk.

Ex-post Portfolio Performance

Owing to the current political turmoil in the Middle East equity markets in the region have shown weak performance in the four months following the data cut-off of this paper. In line with this fact, the Euro-Oil-All M.E. portfolio has underperformed in the period relative to the Euro-Oil with the former declining 5.0% and the latter growing 5.8%. Both series are shown in Figure (8).

[4] While the VaR model employed demonstrates that the Markowitz Middle Eastern portfolio does produce a superior return/risk profile than the simple Euro-Oil alternative, this is not to say that the asset weights are optimal since, as discussed, the normality assumption of the Markowitz framework has been violated. A number of more recent allocation methods address this, two of which are outlined within Appendix (5) for reference.

[5] Olusi and Abdul-Majid (2008) however do not generate portfolios inclusive of an oil asset but focus purely upon Euro-M.E. portfolios. Even grouping the oil and Middle Eastern holdings estimated in this study however gives estimates of 70% and 69% for Jordanian and Saudi Arabian portfolio shares still some 21 and 25 percentage points below the Olusi estimates.

Figure (6): One Year Value-at-Risk (Markowitz Optimal Weights)

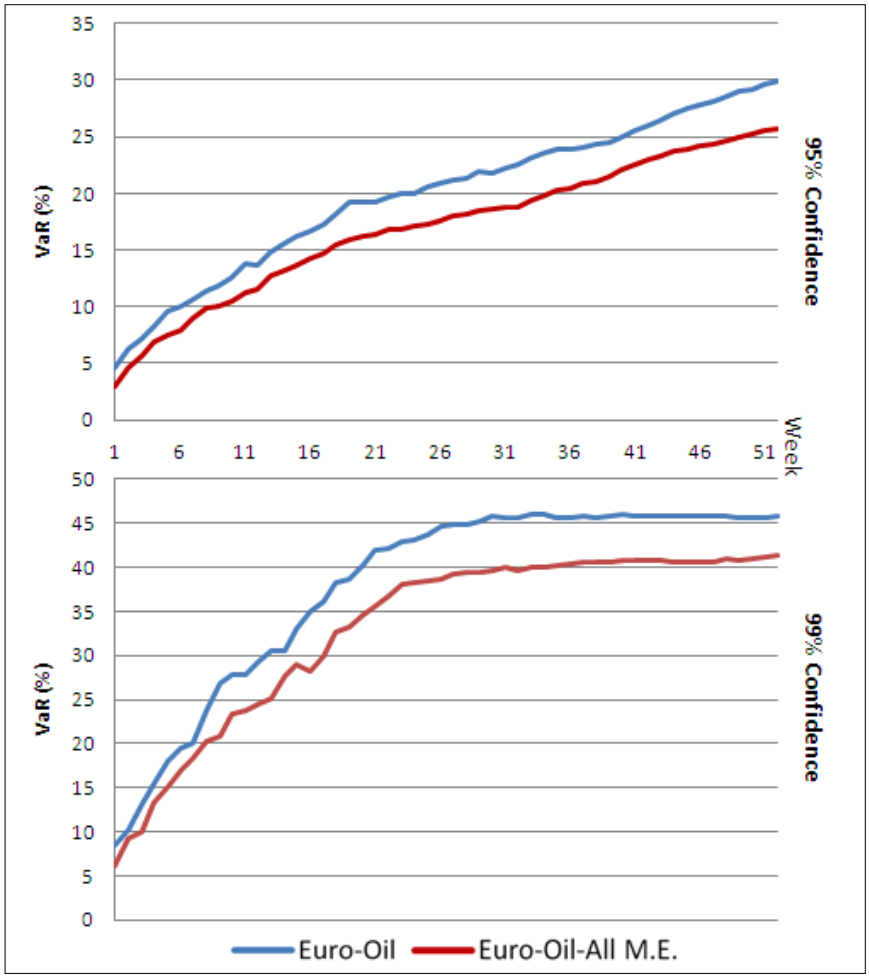


Figure (7): One Year Value-at-Risk (Olusi Asset Weights)

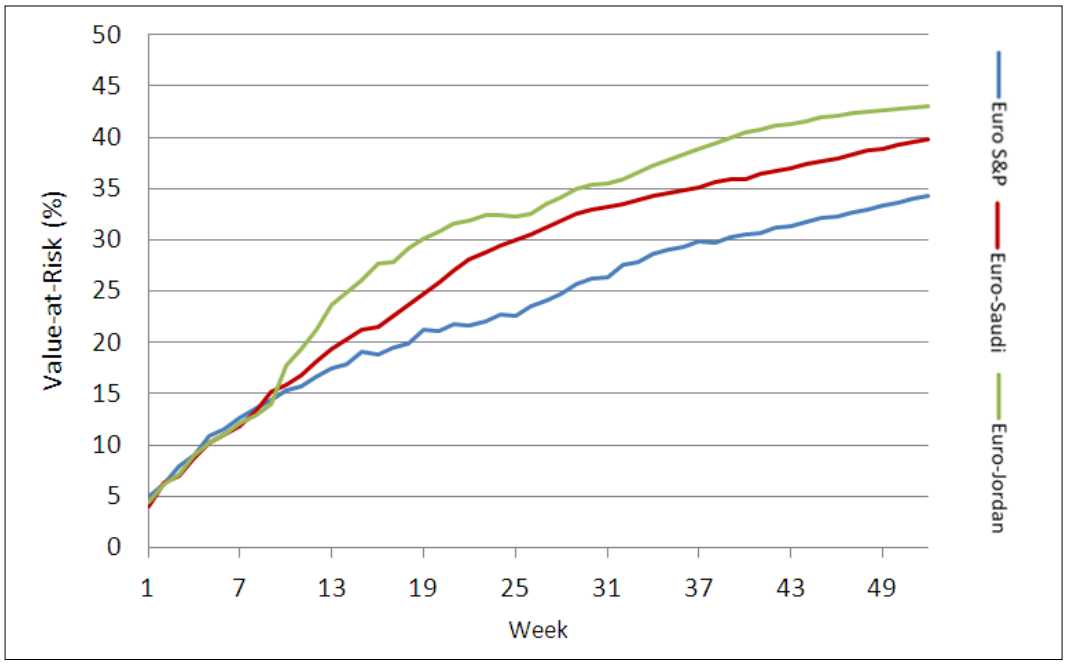
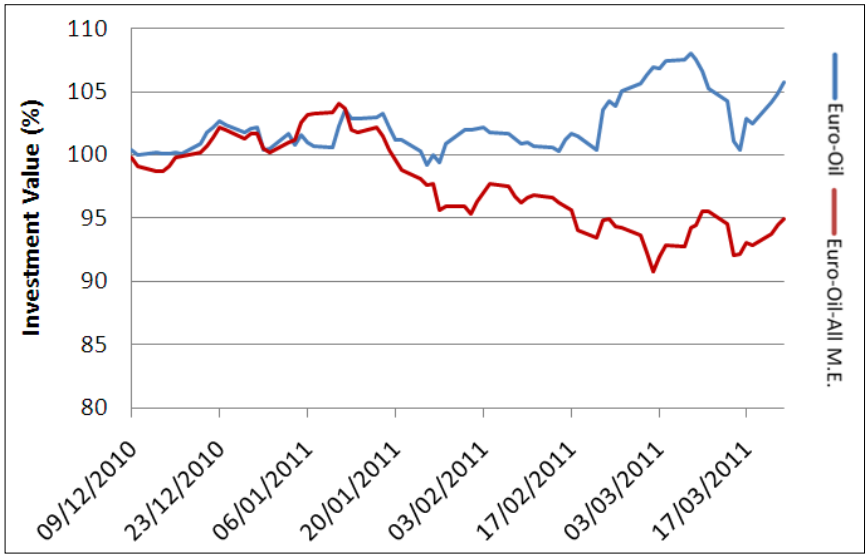


Figure (8): Out-of-sample portfolio returns



Using this data, the Kolmogorov-Smirnov test is conducted with results shown in Table (6). This indicates that, at the 99% significance level, returns observed in the 4 month out-of-sample period are not anomalous to the long-run returns' distributions calculated and employed in this paper for any nation. This is to say that an investor having positioned their portfolio using the estimated long-run metrics would not currently be experiencing market movements beyond the assumptions upon which their investments were based.

(VI) CONCLUSION

Much literature over recent years has focused on the extent to which oil price changes represent a risk to equity growth around the globe. Nowhere is the question more pertinent than in the Middle East where research often assumes the commodity plays such a strong role that economic diversification is nonexistent. This paper finds that pre-2004 such opinion is well-founded as all nations studied, both net-oil-importers and exporters, are significantly sensitive to changes in oil price at index level. Since this date, however, economic diversification has grown at a striking rate throughout much of the region with only Saudi Arabia and Turkey defying this trend. For Saudi Arabia, this continuing oil reliance is arguably an uncontrollable bi-product of market inefficiency, however it may be the 12 year horizon studied is too narrow to observe a gradual, but real, economic transition. The Turkish situation is perhaps more complex. As the nation continues to develop rapidly it will invariably leave itself exposed to oil-risk, possibly more-so now than ever considering the staggering growth in its exports deliverable to the Middle East. This study

emphasises the counterintuitive positive relationship between many emerging markets, such as Turkey, and oil returns which can lead to misinterpretation of the factors driving equity losses in times of market turmoil.

These conclusions are supported well by the subsequent portfolio diversification analysis. This demonstrates all nations create greater return/risk potential for the Euro based investor while the portfolio involving all Middle Eastern index assets performs best. The inclusion of an oil asset in each portfolio highlights the differential properties the Middle Eastern assets provide than investment purely in the commodity itself. The use of a Markowitz framework, while preferred by much of the academic community, poses significant risk in the case of markets with non-normal returns. In this instance VaR analysis demonstrates its performance is relatively robust as the estimated Middle Eastern portfolio continues to outperform its Euro-Oil counterpart.

Finally this paper addresses those individuals who point to the current political turmoil in the Middle East and so scorn these markets for their unpredictability. While it is true that such events are beyond risk framework based upon observed distributional analysis, they are not beyond pre-consideration. It is therefore easy to misinterpret such markets and, as shown, if the Peso Problem is ignored then portfolios can be far too heavily exposed to ex-ante risk factors. This study proposes one such factor to be credit-default probability and provides an example framework from which observed returns' distributions can be augmented to generate long-run estimates. Using these, the observed equity returns in the Middle East since the start of 2011 do not appear statistical outliers. By understanding and modeling these risks therefore, true investment opportunities present themselves. Conversely there are those individuals who will continue to assume an exceptional Return/Risk profile to be exogenous to a given market. As with investors over-exposed to Middle Eastern assets in early 2011 and as with those over-exposed to the Peso in 1976, it is these people who are doomed to repeat history.

Potential areas of study arising from this work include the application of credit-default augmented distributions to other markets as well as a performance comparison of alternative modeling techniques suggested in Appendix (2). Future updates to this paper will also be of great value given the turbulent economic nature of the past decade and the difficulty distinguishing global shocks from true long-run asset properties given only a brief observation period.

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APPENDIX 1: ADDITIONAL DATA AND RESULTS

Table (1): Initial Summary Statistics

	Kuwait	Saudi Arabia	Dubai	Jordan	Turkey	Israel	Euro S&P	WTI	MSCI World
Mean	0.0021	0.0021	0.0026	0.0015	0.0037	0.0020	0.0013	0.0030	0.0009
Std Deviation	0.0250	0.0406	0.0499	0.0268	0.0717	0.0361	0.0289	0.0575	0.0240
Skewness	-0.6225	-1.0791	-0.2318	0.0504	-0.2310	-0.2173	-0.3558	-0.0640	-0.3371
Kurtosis	2.5649	4.6101	3.9374	1.9393	2.0862	1.9537	3.1099	3.8599	2.4650
Sharpe*	0.0839	0.0525	0.0520	0.0543	0.0518	0.0553	0.0434	0.0525	0.0388

The EURIBOR rate used throughout this paper is the annual figure adjusted for a 0.0292607% weekly rate.

*As calculated using a 0% risk-free rate

Table (2): Post-Augmentation Summary Statistics

	Kuwait	Saudi Arabia	Dubai**	Jordan	Turkey	Israel	Euro S&P	WTI
Mean	0.0011	0.0021	0.0019	0.0011	0.0027	0.0014	0.0013	0.0030
Std Deviation	0.0284	0.0406	0.0515	0.0282	0.0726	0.0377	0.0289	0.0575
Skewness	-1.9427	-1.0791	-0.4913	-0.8220	-0.2577	-0.6081	-0.3558	-0.0640
Kurtosis	12.5202	4.6101	4.6323	9.2435	1.9857	3.6998	3.1099	3.8599
Sharpe*	0.0391	0.0525	0.0369	0.0386	0.0371	0.0360	0.0434	0.0525

*As calculated using a 0% risk-free rate

**Data only available from 07/01/2004 when the Dubai Financial Markets exchange opened

These long-run estimates support Bates (1996) theory of Peso Problems in the measurement of skewness and kurtosis. Brooks and Kat (2002) highlight the importance of these moments within investor consideration and argue that more developed markets display more favourable skewness/kurtosis figures. Previously the Middle Eastern distributions opposed this theory with all but two Middle Eastern nations', Saudi Arabia and Kuwait, returns' series closer to normality. Post-augmentation however the Middle Eastern nations' returns' distributions fit much more strongly with these predictions as all nations in the region have lower skewness and higher kurtosis than the Eurozone except Turkey. Consequentially, they look less attractive investments.

Table (3): Asset Long-Run Correlations

	Kuwait	Saudi Arabia	Dubai	Jordan	Turkey	Israel	Eurozone	WTI
Kuwait	1							
Saudi Arabia	0.357 *0.00*	1						
Dubai	0.454 *0.00*	0.492 *0.00*	1					
Jordan	0.414 *0.00*	0.432 *0.00*	0.485 *0.00*	1				
Turkey	0.127 *0.00*	0.165 *0.00*	0.154 *0.00*	0.152 *0.00*	1			
Israel	0.204 *0.00*	0.237 *0.00*	0.294 *0.00*	0.255 *0.00*	0.321 *0.00*	1		
Eurozone	0.134 *0.00*	0.216 *0.00*	0.220 *0.00*	0.218 *0.00*	0.367 *0.00*	0.518 *0.00*	1	
WTI	0.036 *0.31*	0.080 *0.01*	0.106 *0.04*	0.065 *0.05*	0.094 *0.01*	0.124 *0.00*	0.110 *0.00*	1

P-Values are reported in italics below each correlation value

Table (4): Asset weights adjusted to 0.2% weekly return

	Euro-Oil	All M.E.
Euro	0.56	0.08
Oil	0.44	0.21
Kuwait		0.17
Saudi		0.18
Dubai		0.08
Jordan		0.08
Turkey		0.11
Israel		0.03
Risk-Free		0.06
Mean/ %	0.20	0.20
SD/ %	3.15	2.33

Table (5): Five year Value-at-Risk statistics

Confidence Level	Value-at-Risk (%)	
	Euro-Oil	Euro-Oil-All M.E.
90%	30.83	31.58
91%	33.41	33.81
92%	36.23	36.04
93%	39.17	38.47
94%	42.30	41.04
95%	45.35	43.82
96%	49.01	46.73
97%	53.66	50.42
98%	61.03	55.01
99%	64.01	61.91

Table (6): Kolmogorov-Smirnov Test

H0: Estimated long-run and ex-post distributions identical
H1: Significant difference between esimate and ex-post returns

	Test Statistic	P-Value
Kuwait	0.0052	1.00
Saudi Arabia	0.0068	1.00
Dubai	0.0080	1.00
Jordan	0.0052	1.00
Turkey	0.0037	1.00
Israel	0.0039	1.00
Euro	0.0030	1.00
WTI	0.0018	1.00

APPENDIX 2: DISTRIBUTION MANIPULATION

This section documents the work undertaken and data used to augment the observed Middle Eastern returns' distributions by the credit-default factor to create the long-run returns' distribution estimates. While the theoretical reasoning behind this process is detailed in the main body of text, the actual method used to adjust the distributions is relatively less important and so is not awarded a place therein. A second similar augmentation process is proposed at the end of this appendix which better addresses the concerns of more active asset managers. Data used a graphic example are presented following description of the methodology.

Credit Augmented Returns' Distributions

Five year credit default swap (CDS) data is first obtained via Datastream for all sampled Middle Eastern countries as well as those Eurozone nations which comprise the Euro S&P index over the same period as the portfolio data. The great majority of nations did not have listed CDS prices pre-2005 and so where this was the case, the longest obtainable dataset was used for the calculations. From this data a composite CDS price was generated for the Eurozone with each Euro nation weighted to the same extent as in the S&P index. The average premium of the Middle Eastern CDS over the Eurozone CDS was then calculated and defined as an estimate of the long-run sovereign risk in the region over that of the Eurozone. For ease of explanation these values are termed the *CDS Excess*.

In order to make a meaningful comparison between Middle Eastern nations and one which has undergone sovereign default, the Russian example of 1998 was chosen. This comparison is well justified within the work of Bhar and Nikolova (2010) and so appeared the most appropriate choice of nation. Russian equity index returns data were therefore obtained from Datastream for the four month period surrounding when the country experienced sovereign default and the modal return calculated (-16.1%). This data length was selected using a Zivot-Andrews test to indicate the point of structural break in the equity index value. The proportion of the Euro S&P returns observed below this mode was calculated and termed *"the default region"* being the area within which weekly index returns lie on average under the situation of a sovereign default. For each of the Middle Eastern nations, points were randomly sampled from the Russia default data and added to the Middle Eastern returns' data until the Middle Eastern *default region* was larger than that of the Eurozone *default region* by the proportion implied by the *CDS Excess*. The four moments of this new Middle Eastern distribution were measured (mean, standard deviation, skewness and kurtosis). The process was then repeated and the average values of these four moments calculated. The interpretation of these averages is therefore as the long-run distribution estimates formed through the augmentation by the credit-default factor of the short-run observed distributions.

From the below data, it can be seen that the original Saudi Arabian *default region* (ie. before augmentation) relative to that of the Eurozone is already larger than the *CDS Excess* for the country. This implies that the

observed distribution fully incorporates the nation's excess sovereign risk above that of the Eurozone and so already represents the long-run returns' series. As a result the observed estimates were used for Saudi Arabia without augmentation by the credit default factor.

I) Default Augmentation Process- Data

Euro CDS Weights (%)	
France	29.07
Germany	19.77
Italy	12.21
Spain	11.05
Netherlands	9.88
Belgium	6.40
Portugal	4.07
Greece	2.91
Austria	2.33
Ireland	2.33

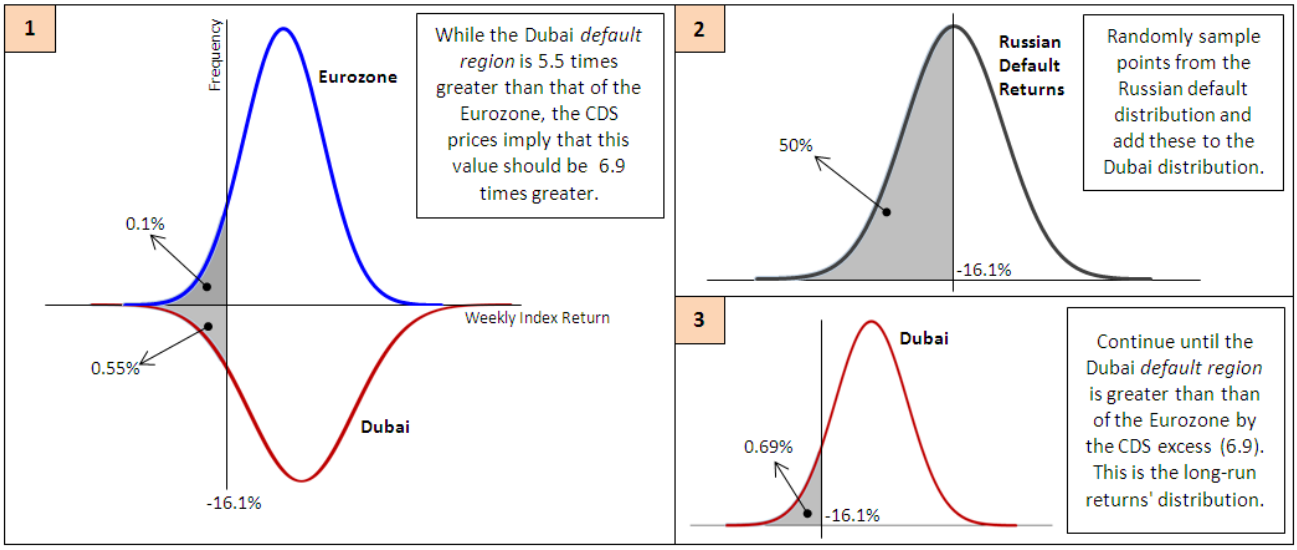
Long-run CDS price excess over the Eurozone (%)					
Kuwait	**Saudi**	**Dubai**	**Jordan**	**Turkey**	**Israel**
414	188	686	124	2391	459

Original *Default Region* excess over the Eurozone (%)					
Kuwait	**Saudi**	**Dubai**	**Jordan**	**Turkey**	**Israel**
240	637	552	0	2151	340

Credit Default Augmentation Required?					
Kuwait	**Saudi**	**Dubai**	**Jordan**	**Turkey**	**Israel**
Yes	No	Yes	Yes	Yes	Yes

Russian Default Data	
Mean	- 0.142
SD	0.073
Skewness	0.161
Kurtosis	2.525
Mode	- 0.161

II) Default Augmentation Process- Example



Alternative Multi-Period Investment Methodology

While the previous methodology appears appropriate for those investors with an extremely long-term investment horizon it may appear less appropriate for those with a shorter view. In this case, a suggested alternative methodology for developing returns' distributions independent of the Peso Problem would be to create *multi-period default augmented returns' distributions*.

This could be done by calculating each market's CDS Excess above the Eurozone on a daily/weekly basis using only the current CDS prices instead of taking the long-run average. This measurement represents the

current expectation of the five-year excess risk (over the Eurozone) in the respective market. Repeating all other steps detailed above using this new metric, returns' distributions are formed from which assets can be compared to form portfolios with the optimum five-year return/risk characteristics. Using this strategy, the optimum asset allocations will therefore adjust with changing CDS prices relative to the base market (the Eurozone in this example) and so active portfolio management is required. In times of political turmoil, capital will flow from the afflicted region while relative stability will create a greater return/risk profile therefore encouraging large capital inflows. While empirically such capital movement is often observed, this framework gives a rigorous method through which to quantitatively guide such investment decisions. Further work directed at this strategy is proposed in order to ascertain its performance relative to the long-run alternative used within this paper.

APPENDIX 3: SECTOR LEVEL ANALYSIS

While of value for reference to both the investment community and Middle Eastern policy makers, the sector-level analysis undertaken is not central to the macro-level diversification analysis of this work and so is excluded from the main body of text.

Data

Summary statistics for each sector are presented at the end of this appendix. Standardised sector groupings were obtained through the aggregation of the individual nations' sectors as reported by each stock exchange. Furthermore the Saudi Arabian sector groupings were rebuilt in order to obtain a richer dataset than otherwise possible. This was done using the five largest companies in each sector as measured by market capitalization. Average sector returns are broadly in line with index returns with the major exception being the negative observations for all but two countries in the Technology sector. This could well result from the sector developing relatively recently as compared to others meaning the majority of its lifespan in the region to date has coincided with the recent financial crisis.

The clearest metric for comparison again appears the Sharpe ratio. Using this, a striking trend in the data is the strong performance of the Banking sector, falling in the top three sectors in all countries. Similarly in all countries but Jordan and Dubai, the Real Estate group returns sit in the bottom two sectors. While the Technology group performed worst in Saudi Arabia, Israel and Turkey, it sits in the top three performing sectors within Jordan. The Energy sector outperforms all others appearing in the top two sectors in all nations except Kuwait. The implication of this finding is that if nations are not yet diversified away from the Energy sector at index level, an investor would do best to place their funds solely into this sector reinforcing the chain of reliance upon the commodities which drive this group. The methodology employed to analyse the sector-level movements is identical to that of the index analysis discussed in the main text.

Results and Conclusions

Underlying the index results are the sector level estimates which help to demonstrate the driving forces leading change within each nation (see end) From these, Kuwait's fall to index level independence from oil price changes appears to be driven by declines in the Services and Banking sectors' sensitivity to this factor. Similarly it is the reliance of these two industries' returns upon oil which is found to decline most since 2004 within Israel. Given the diversification of capital flows discussed throughout the region this is reasonably intuitive but is of particular interest given that it contradicts Faff and Brailsford (1999) who suggest that the banking industry is last to diversify itself from an economically pervasive commodity. Their study is also of value in the case of industries where increased sensitivity is observed but with no other discernible change in the sector's relationship with oil such as the Jordanian Real Estate Sector. The causation described in this case is one of an industry within which firms can increasingly pass on costs to their clients or become more

effective in price-risk hedging. Consistent with expectations, the Energy sector remains positively sensitive to oil price changes throughout the net-oil-exporter nations. These estimates therefore provide a strong reference point for any investor attempting to gauge micro-level changes in sector linkage to oil throughout the region.

At a sector level there are few similarities between nations in terms of the changes in oil price sensitivity. This is to say that each country appears to be shedding its oil reliance in different ways. For investors and policy makers alike, it is the risk inherent in those industries which show no increasing diversification to which attention ought to be directed.

Sector Summary Statistics

		CAP	CCS	EU	BFI	REC	TMT
KUWAIT	Mean	0.003	0.004	0.002	0.002	0.001	0.002
	SD	0.032	0.034	0.033	0.031	0.034	0.027
	Skewness	0.443	-0.117	0.141	5.989	0.083	-0.158
	Kurtosis	5.458	3.302	4.833	3.586	3.258	3.259
	Sharpe*	0.080	0.110	0.057	0.070	0.044	0.061
S. ARABIA	Mean	0.004	0.004	0.005	0.002	0.003	-0.002
	SD	0.064	0.065	0.070	0.038	0.057	0.045
	Skewness	-0.546	0.663	1.164	0.061	-0.566	-0.459
	Kurtosis	4.780	7.390	13.605	3.234	6.311	3.770
	Sharpe*	0.063	0.065	0.070	0.065	0.058	-0.055
DUBAI	Mean	-0.002	-0.000	0.003	0.003	0.002	-0.001
	SD	0.034	0.054	0.056	0.045	0.087	0.063
	Skewness	-1.889	-0.549	1.111	0.294	-2.251	0.184
	Kurtosis	17.405	3.875	3.755	3.949	28.416	4.600
	Sharpe*	-0.048	-0.005	0.045	0.064	0.028	-0.020
JORDAN	Mean	0.001	0.001	0.003	0.003	0.002	0.002
	SD	0.019	0.019	0.030	0.025	0.031	0.028
	Skewness	0.139	0.321	-0.210	-0.116	0.113	-0.174
	Kurtosis	1.401	3.868	4.689	2.401	2.367	4.854
	Sharpe*	0.047	0.052	0.102	0.101	0.066	0.077
TURKEY	Mean	0.004	0.004	0.004	0.005	0.001	-0.000
	SD	0.061	0.069	0.069	0.076	0.069	0.069
	Skewness	-0.532	-0.204	-0.250	-0.177	-0.362	-0.757
	Kurtosis	2.729	2.545	2.528	1.822	2.407	2.581
	Sharpe*	0.060	0.052	0.058	0.068	0.009	-0.004
ISRAEL	Mean	0.002	0.002	0.003	0.002	0.001	-0.001
	SD	0.036	0.036	0.045	0.040	0.037	0.043
	Skewness	-0.283	-0.086	1.022	-0.222	-0.262	-0.088
	Kurtosis	1.806	1.712	7.131	1.905	1.386	2.298
	Sharpe*	0.055	0.046	0.061	0.048	0.023	-0.020

CAP	Consumer and Agricultural Products
CCS	Consumer and Corporate Services
EU	Energy and Utilities
BFI	Banking, Finance and Insurance
REC	Real Estate and Construction
TMT	Technology, Media and Telecommunications

* As calculated using a 0% risk-free rate

Sector-Level estimates fitted using equation (1)

		CAP	CCS	EU	BFI	REC	TMT
KUWAIT	b1	0.050* *2.72*	0.057* *2.35*	0.056* *2.10*	0.044* *2.44*	0.031 *1.28*	0.064* *2.92*
	b2	0.007 *0.21*	-0.119* *-2.51*	-0.060 *-1.26*	-0.075* *-2.43*	-0.018 *-0.43*	-0.052 *-1.37*
	b1+b2**		-0.062* *2.28*		-0.030 *1.51*		
SAUDI ARABIA	b1	0.070* *3.56*	-0.082* *-2.81*	0.158* *5.06*	0.114* *4.39*	0.106* *3.06*	****
	b2	-0.059 *-1.28*	0.105* *2.29*	-0.044 *-0.93*	-0.006 *-0.12*	-0.045 *-0.85*	0.004 *0.1*
	b1+b2**		0.023 *0.42*				
DUBAI***	b2	-0.030* *-16.8*	-0.020 *-0.3*	0.033 *0.73*	0.004 *0.911*	0.003 *0.05*	-0.023 *-0.44*
	b1+b2**						
JORDAN	b1	-0.015 *-0.7*	0.001 *0.05*	-0.013 *-0.66*	-0.017 *-0.84*	-0.047 *-1.9*	0.008 *0.5*
	b2	0.015 *0.51*	0.024 *1.08*	0.021 *0.61*	0.303 *0.99*	0.087* *2.36*	-0.038 *-1.43*
	b1+b2**					0.039* *2.09*	
TURKEY	b1	0.105* *2.18*	0.080* *2.22*	0.113* *2.84*	0.090 *1.3*	0.105* *2.55*	0.026 *0.61*
	b2	-0.057 *-0.88*	0.003 *0.87*	-0.001 *-0.29*	-0.037 *-0.43*	-0.013 *-0.15*	0.004 *0.87*
	b1+b2**						
ISRAEL	b1	0.066* *2.59*	0.117* *4.05*	0.077* *2.85*	0.093* *3.23*	0.084* *3.15*	0.068 *1.61*
	b2	-0.052 *-1.51*	-0.135* *-3.30*	-0.090* *-2.33*	-0.096* *-2.11*	-0.051 *-1.27*	-0.331 *-0.65*
	b1+b2**		-0.019 *0.41*	-0.012 *0.21*	-0.003 *0.01*		

All other coefficients within equation (1) are estimated but are not reported. P-Values are presented in italics.

*Significant at the 5% level

**This value is only calculated where this is a significant value upon the b2 variable

***Dubai estimates were only fitted post-2004 owing to the insignificant sample available before this date

****Result omitted owing to insiginificant observation period

APPENDIX 4: ALTERNATIVE ASSET ALLOCATION

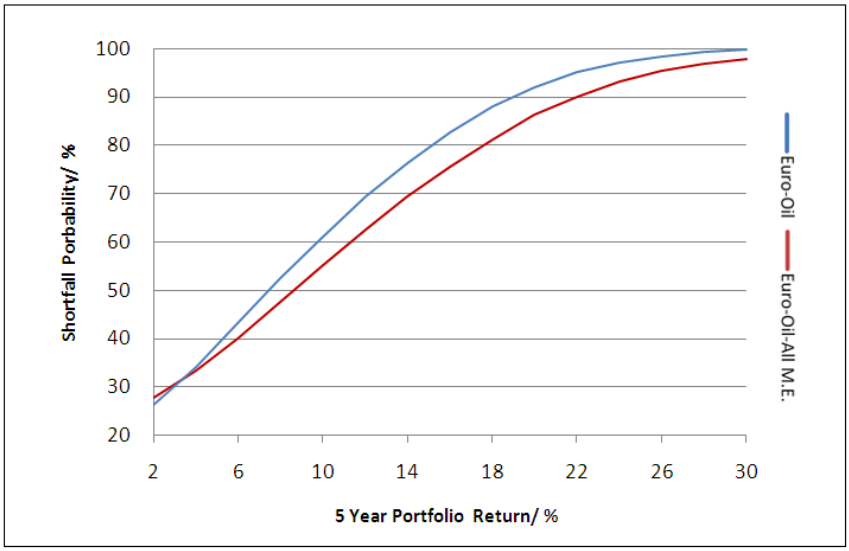
This section provides a summary of two portfolio allocation algorithms developed more recently than the Markowitz framework. In portfolio creation, all allocation alternatives should be considered as each serves a different purpose through targeting different investment or investor properties. Applying each approach to the empirical study of this work demonstrates that a Middle Eastern inclusive portfolio by large appears superior to the Euro-Oil case.

Target Shortfall Criterion

Under this framework the investor chooses the critical acceptable level of the portfolio's excess growth rate (above the risk-free asset) and the algorithm then allocates asset weights in order to minimise the probability of falling short of this level. It is important to note, this critical growth rate is defined for the entire life of the portfolio rather than simply a one year period.

Further Reference: Stutzer (2003)

Performance Analysis



OPTIMAL WEIGHTS	Euro-Oil	Euro-Oil-All M.E.
Euro	0.42	0.19
WTI	0.46	0.38
Kuwait		0.20
Saudi		0.24
Dubai		-0.13
Jordan		0.15
Turkey		0.09
Israel		0.02
Risk-Free	0.13	-0.14

NET ANNUALISED STATISTICS		
Mean (%)	8.82	9.97
SD (%)	19.95	19.79
VaR (%)	4.35	4.19

The Middle Eastern inclusive portfolio gives lower shortfall probabilities than the Euro-Oil case over a 5 year horizon. It also has a higher one year return, lower annual SD and lower annual Value-at-Risk. The VaR metric is formed using the long-run distributions and so is inclusive of kurtosis and skewness measures. The Middle Eastern portfolio therefore appears superior.

Utility Function Criterion

This second methodology aims to allocate assets to maximise the expected value of a given investor utility function based upon portfolio wealth over all admissible portfolios. In a multi-period model this is done by using relative risk aversion functions. The difficulty in taking this approach, well covered in literature, is the degree to which an individual's risk aversion can be miscalculated especially given findings that this value can vary depending on specific circumstances. For the below analysis, cubic utility functions were assumed as per Levy (1969).

Further Reference: Jondeau and Rockinger (2006)

Performance Analysis

OPTIMAL WEIGHTS	Euro-Oil	Euro-Oil-All M.E.
Euro	0.31	0.16
WTI	0.34	0.32
Kuwait		0.17
Saudi		0.20
Dubai		-0.11
Jordan		0.13
Turkey		0.08
Israel		0.01
Risk-Free	0.35	0.04

NET ANNUALISED STATISTICS		
Mean (%)	6.51	8.41
SD (%)	14.72	16.67
VaR (%)	3.21	3.53

The Middle East inclusive portfolio has a higher return but also a higher SD than the Euro-Oil case. With Sharpe ratios of 0.50 and 0.44 respectively, a traditional framework suggests the All M.E. portfolio is superior. The caviat to this conclusion is the slightly higher one year VaR of this portfolio. Calculating a Return/Risk statistic by dividing the return by the VaR implies the M.E. portfolio performs best however this will be dictated by the weight each investor places upon the VaR statistic.