Leverage versus Volatility: Evidence from the Capital Structure of European Firms

AbdelKader O. el Alaoui[a], Obiyathulla Ismath Bacha[a], Mansur Masiha[a], Mehmet Asutay[b]
[a] INCEIF, Lorong Universiti A, 59100, Kuala Lumpur, Malaysia
[b] Durham University Business School, Mill Hill Lane, Durham DH1 3LB, UK

Abstract:

The impact of leverage on financial market stability and the relationship with the real economy is a key concern among researchers. This paper makes an initial attempt to investigate the relationship between a firm's leverage, return and share price volatility from an Islamic finance perspective and capital structure theory. A multi-country dynamic panel *framework and* the mean-variance efficient frontier are applied to 320 sample firms from eight European countries, divided into portfolios of low and high debt using the shari'ah screening threshold of 33%. We find that the firm's return and volatility change with changes in the capital structure. Islamic-compliant stocks show, in most cases, less volatility than non-compliant stocks but are no different in terms of return. Finally, our results imply a case for limiting debt beyond certain levels.

Keywords: volatility, leverage, Islamic stocks, mean-variance efficient frontier, dynamic GMM, wavelet time–frequency coherence analysis.

1. Introduction

The financial sector appears to be playing an increasingly important role in the macro economy. The increasing frequency of financial crises and their much deeper costs on society make the understanding of financial markets a key ingredient of macroeconomic management. Given the globalized nature of financial markets and economies, contagion across borders is a reality. Thus, what begins as a local problem can quickly translate into a regional and global crisis through contagion. The US subprime crisis of 2007-8 is a case in point. What began as a bubble in the American mortgage market - a small segment of the real estate market, produced within a short time span, a recession and a downward spiral, the likes of which the US economy had not witnessed in recent times. This crisis has shown: (i) the centrality of the financial system in the functioning of the real economy (ii) the importance of the leverage in producing shocks and crisis. If as Rogoff and Reinhart (2010) have argued, excesses with debt have been at the root of all modern financial crises, then limits on the buildup of debt would make eminent sense. Interestingly, Islamic finance which emanates from religious philosophy places limits on acceptable levels of debt. The accepted rule is to allow firms to have debt ratios no higher than 33%. In this study, we examine the impact of such limitation on stock price volatility and in stabilizing financial markets.

Specifically, when stocks are screened for their acceptability within Islamic portfolios, one of the key filters used is a maximum debt ratio of 33%, either to "total assets" or to "market capitalization". Such an imposition may not be in line with capital structure theory which advocates a mix between debt and equity to optimize a firm's value (Modigliani & Miller, 1958 and 1963). Thus, this study makes an initial attempt to investigate the impact of this screening filter on the leverage and returns of shari'ah compliant portfolios.

Moreover, understanding the level of corporate debt and volatility in relation to contagion under normal economic conditions and under shocks has been a subject of several studies. Finance theory suggests that volatility and firm's debt are correlated positively (Samuel, 1973; Sporleder and Moss 2004; Cai and Zhang, 2006; Graham and Leary 2011). Volatility increases during crisis period by driving contagion into inter-related capital markets which become more correlated during turmoil conditions. In periods of contagion, firms with higher leverage become more vulnerable to market and financial risks (Ahmad et al.; 2013; Duncan and Kabundi, 2013, Hwang et al., 2013 among others). The post-2008 global financial crisis (GFC-2008) failure of giant financial firms (e.g., *Lehman Brothers, Goldman Sachs*) reminds us that high leverage, inter alia, does not necessarily reduce the firm's overall cost of capital, rather it increases company's risk and chance of failure. Risk-averse investors wanting to minimize their investment's risk, expect an optimal balance between debt and equity and they fear that an increase of debt could increase default risk. Although risk-loving investors may be ready to accept a project with high leverage, they want to be compensated for the higher risk involved with the leverage.

There is a temptation for firms to raise capital through the market mechanism of debt rather than equity financing, as the tax shield of debt makes the cost of financing, in most cases, considerably lower. Nonetheless, in the absence of the tax deductibility, which is the case in only few countries in the world, the capital structure theory with risk-neutrality assumption (Smith and Conover, 1993), suggests that there is no benefit for borrowing. Accordingly, based on the assumption of risk-neutral market participants (Modigliani and Miller, 1958), firms would be indifferent to the source of capital if the cost of equity is less (or equal) compared to the cost of debt.

Compared to the conventional theory of debt management, Islamic finance advocates for less debt and offers an efficient alternative strategy based on the principle of risk sharing, participation and fair partnership (for example, *musharakah* or *mudarabah* contracts). According to Islamic finance principles, investors have to negotiate the profit sharing ratio and shall expect better reporting quality and transparency. Subsequently, they may expect higher profit sharing ratio in the case of riskier projects. Moreover, the nature of the contracts in Islamic finance encourages the strengthening of good corporate governance since the partnership conditions should be fairly and clearly specified between the contracting parties and validated by the *Sharia'h* board of each contracting party.

While there is a good number of studies analyzing volatility and contagion across different countries and markets, the linkage between volatility and firm leverage is largely unexplored. Moreover, very few studies have applied *Islamic* stock screening filters (quantitative and qualitative) to study volatility and its relation to contagion during the GFC-2008. We fill this gap by introducing the Islamic finance principles relevant to the stock market and investigate whether lower leverage, as suggested by the Islamic principles, can reduce volatility, therefore, bringing more micro-stability to the capital markets.

This study investigates the extent to which the leverage induces the share price volatility. It also, examines whether firms with weak capital and high level of debt ratios (high leverage position) are more vulnerable to volatility spillovers.

Specifically we address the following key research questions: (i) Do the firms' return and volatility change with changes in capital structure?; (ii) How do *Shari'ah*-compliant stocks perform in terms of leverage and volatility?; (iii) How do portfolios of *Shari'ah*-compliant stocks and non-compliant stocks compare in terms of their risk-return profiles (including GFC-2008 period)?

The study uses a sample of 320 European companies (representing 8 countries) distributed over different portfolios of high and low debts.

To investigate the leverage effect on volatility and returns, we adopt three different approaches. First, we use the dynamic panel techniques based on vector autoregressive framework to control simultaneously the level of debt (leverage) effect and the country effect on returns and volatility. Moreover, we apply the *Mean-Variance Efficient Frontier (MVEF)* by computing the risk-return profile of a large number of random possible portfolios constructed as high and low debt firms from major European countries. Subsequently, this helped us formalize the debt impact on their different random profitability outcomes and its relation to the European market stability. The portfolios span eight countries including the UK market considered as the biggest financial market in Europe.

Dynamic GMM framework has been used based on the 33% Shari'ah stock screening threshold[1]. To make our results robust while looking to overcome heterogeneity across firms, we use dummy variables linked to the level of debt (measured as total debt over total assets) as suggested by the Islamic stock screening process. Furthermore, considering the nature of the selected firms (mainly from the productive sectors), the firm's size, the level of sovereign debt and the exchange rate have been added to the explanatory variables to capture the foreign currency effect for the firms originating in countries within and outside the Euro zone.
Then, the MVEF approach shows that low debt portfolios are more likely to provide more stability with higher return than high debt portfolios.

[1] This quantitative financial debt ratio or leverage threshold of 33% has been specified by the standards N°21 – 3/4/2 rules of AAOIFI (The Accounting and Auditing Organization for Islamic Financial Institutions, 2010). See Appendix D.

Finally, the Wavelet Transform Coherence technique *(WTC)* is then applied to the UK market. It helps us investigate the lead-lag relationships (in terms of contagion effect) at different stock-holding periods or investment horizons of the investors. Based on cross correlation between different variables, this technique can also identify the variables to be considered in the panel data econometric modeling.

Overall, the results tend to indicate significant correlations between "debt to equity" ratio and both returns and volatility, but not necessarily with high debt to assets given the different sizes and growth of firms. The study tends to suggest three main factors which need to be considered by the firms in order to improve their stability in the market: firstly, the level of "debt to equity" as suggested by the capital structure theory rather than "debt to total assets" as suggested by the current practice of Islamic Finance Perspectives (IFP); secondly, the capitalization or the firm size; and finally, the level of the sovereign debt and country dynamics. Although the latter may be beyond the firm's control, it is up to the firm to consider its own market with implications on its leverage policy in relation to the frequency-dependent strategy.

The remainder of the paper is arranged as follows: section 2 presents the literature review, section 3 discusses the research methodology of the study, section 4 discusses the results, and lastly section 5 provides some reflections on the conclusion and the policy implications.

2. Literature Review

This section examines the underlying concept, methodologies and findings from major empirical studies related to total volatility and return.

2.1 Studies on capital structure

Studies of firm's capital structure have evolved and consequently various determinants based on firm characteristics and country specific factors have been generated and included. The relationship between firm leverage and country specific factors has been extensively studied (see among others, Booth *et al.* (2001), Deesomsak *et al*. (2004), De Jong *et al.* (2008), Driffield and Pal (2008), and Kayo and Kimura *et al*. (2011)). Their findings reveal that not only firm characteristics but also country specific factors do have significant influence on a firm's financing. For example, Booth *et al*. (2001) found that corporate financing was affected by determinants related to country specific factors in developed countries with country specific differences that spread across countries. The country specific determinants should not be neglected in the capital structure analysis since they have a sizeable explanatory power (De Jong *et al*., 2008).

Firm debt has been identified as one of the variables representing firm specific factors. Therefore, this study intends to fill the gap by analyzing the impact of firm debt on volatility and contagion.

This study is particularly important with regards to the recommendations provided by AAOIFI (2004, 2010) and the position held by most of the recognized scholars in Islamic finance on corporate debt (Ghoul and Karam, 2007). From the Islamic investment perspectives, portfolios have to be *Sharia'h* compliant both qualitatively and quantitatively. Specifically, the debt ratio (to total assets or to market mean value including long-term and short-term debts) of any listed firm has to be less than one-third -- considered as commonly used tolerance threshold (Bin Mahfooz and Ahmed, 2014). Our objective is to show the extent to which the leverage would be detrimental to volatility and returns in capital stock market. We enumerate its role in the shock transmission that could worsen both returns and volatility. Excessive debt that brings high "unnecessary volatility" (could be interpreted as "*Gharar*" in Islamic finance) is considered as a crucial issue that puts households' investments at artificial higher risk or unnecessary risk.

2.2. Approach for measuring total volatility and returns

This study also aims to measure the effect of volatility as such this section discusses the conceptual base of such measurement. For example, Christie (1982) computed the standard deviation, of the return, using a regression that has been augmented with lagged volatility to treat autocorrelation in volatility.

In providing a different perspective, Dufee's (1994) model was based on the log difference of the standard deviation as function of returns times a coefficient called λ_0 following the equation ($Log\left(\frac{\sigma_{t+1}}{\sigma_t}\right) = \alpha_0 + \lambda_0\, r_t + \varepsilon_{t+1,0}$). The interpretation of this negative coefficient was that a positive r_t corresponded to a decrease in σ_{t+1}. Dufee (1994), therefore, argued that the primary reason for $\lambda_0 < 0$ was that a positive r_t corresponded to an increase in σ_t. Moreover, Christie had decomposed Dufee's econometric model into two equations:

$Log\,(\sigma_t) = \alpha_0 + \lambda_1\, r_t + \varepsilon_{t,1}$ and $Log\,(\sigma_{t+1}) = \alpha_0 + \lambda_2\, r_t + \varepsilon_{t+1,2}$, where λ_0 was computed as a difference between λ_2 and λ_1 ($\lambda_0 = \lambda_2 - \lambda_1$). This showed that there was no clear relation between returns and volatility (r_t and σ_{t+1}). Christie had found that the covariance between λ_0 and firm leverage was strictly negative and near to one [Cov (λ_0 , Firm Leverage) << ~ -1], while Cheung and Ng (1992) found that the covariance between λ_0 and firm size was strictly positive and also near to one [Cov (λ_0 , Firm Size) >> ~ 1]. In giving an empirical meaning, Dufee (1994) found that for the typical firm traded on the New York Stock Exchanges, λ_1 was strongly positive, while the sign of λ_2 depended on the frequency these relations were estimated: it was positive at the daily frequency and negative at the monthly frequency. In both cases $\lambda_2 < \lambda_1$, so $\lambda_0$was negative.

Black (1976) conducted the first empirical work on the relation between stock returns and volatility. Using a sample of 30 stocks (from the Dow Jones Industrials), he constructed monthly estimates of stock return volatility over the period of 1962-1975 by summing squared daily returns and taking the square root of the result. For each stock *i*, he then estimated [$\frac{\sigma_{i,t+1}}{\sigma_{i,t}} = \alpha_1 + \lambda_0 r_t + \varepsilon_{i,t+1}$].

If there were *N*, days in month *t*, the estimated standard deviation was: $\sigma_t^2 = \sum_{k=1}^{n} r_{t,k}^2$.

French *et al.* (1987) proposed an alternative volatility estimate that adjusts for first-order autocorrelation in returns [$\sigma_t^2 = \sum_{k=1}^{N} r_{t,k}^2 + 2 \sum_{k=1}^{N-1} r_{t,k}\ r_{t,k+1}$], where *N* were the number of days in the period *Q*.

From the Dufee (1994) Model, we can note that λ_0 should be related to the two parameters: debt and firm size. Because of its 'staticticity', we note that this model is not adapted to the debt dynamic's feature.

Jan Ericsson *et al.* (2007) used a dynamic model taking into account the level of debt [$\Delta\sigma_t = \alpha + \phi_1 D_{it} + \phi_2\sigma_{t-1} + \varepsilon_t$]. In its bi-variate system, the parameters were the same as if the equations were expressed in levels [$\Delta\sigma_{it} = \phi_1 \Delta D_{i,t-1} + \phi_2\Delta\sigma_{t-1} + \Delta\varepsilon_{t2}$]. In its tri-variate system, the change in returns was added to the model [$\Delta\sigma_{it} = \mu_1 \Delta D_{it} + \mu_2\Delta\sigma_{t-1} + \mu_3\Delta r_{t-1} + \Delta U_{t2}$].

Engle and Ng *et al.* (1993) reported that conditional volatility of stock returns was negatively correlated with past returns (see among; Glosten, Jagannathan and Runkle, 1993; and Wu, 2001). Thus, an asymmetric response of equity systematic risk to past stock performance could be transmitted through variance asymmetry channel.

The model used by Smith and Yamagata (2011) had the same set of variables in the right hand side for returns and volatility $Log(\sigma_{it})$. They based their model on business cycle, firm characteristics and sectors returns and volatility by using the value-weight (of the S&P500) for the i^{th} firm of the s^{th} industrial sector.

They imposed the restriction that a single firm did not affect the market, business cycle variables or industrial sectors contemporaneously. Their model was limited to the US markets and while it integrated the different level of lagged returns and volatility, it did not consider the direct impact of the firm's debt level. To illustrate the contemporaneous firm-level effects, they based their model on the Whitelaw (1994), and Brandt and Kang (2004), Pesaran *et al.* (2004) and Dees *et al.* (2007), and applied the re-parameterization principle. This allowed them to show the connection to lagged return and lagged volatility of the firm and the sector (lags =1), in the mean models. They added estimates to show contemporaneous firm-level leverage effects, lagged firm-level leverage effects, and contemporaneous and lagged market return effects on firm volatility.

We consider this model helpful in the way that it brings to the model the vector of business cycle variables. The vector (d_{it}) is added to the retained econometric model. We extend the methodology of Smith and Yamagata (2011) by combining it with the latest model that takes into account the change in debt (Whitelaw (1994), and Brandt and Kang (2004), Pesaran *et al.* (2004) and Dees *et al.* (2007)).

Jie Cai & Zhe Zhang (2011) used the Capital Asset Pricing Model (CAPM) based on the Fama-French (1993) three-factor model, and the Carhart (1997) four-factor model (three-factor plus the momentum factor). Whereby, they examined whether the observed negative relation between leverage changes and stock returns reflects these stocks' different cross-sectional loadings on systematic risk factors. They ran the time–series regression that took into account the monthly portfolio returns, risk-free rate (measured by the one-month T-bill yield), factor returns including market excess returns, returns of the Fama-French size factor (SMB), book-to-market factor (HML), and the momentum factor (UMD). They obtained the return series of these factors and the one-month T-bill yield from Kenneth French's website. The alphas from the regressions represented the risk-adjusted returns of the portfolios. They expected the alphas to be similar across all the portfolios.

Although the factor models could not explain the negative relation between changes in leverage ratio and next-quarter stock returns, a firm's capital structure choice might depend on other firm characteristics not captured by these factors. Furthermore, Daniel and Titman (1997) argued that characteristic-based models could better explain the cross-sectional variation of stock returns. It was possible that the negative effect of leverage changes on stock returns could be explained by other firm characteristics. To examine the marginal effect of leverage change on cross-sectional stock returns, they estimated Fama-Macbeth (1973) type cross-sectional regressions of monthly individual stock returns on the change in leverage ratio of the most recent fiscal quarter, among other control variables. Their model had used the leverage change (during the most recent fiscal quarter leverage ratio at the beginning of the previous quarter) and a control vector that took into account: the market value of equity, book-to-market ratio, past one-month return, past one-year stock returns and previous quarter's ROE.

Fama and French (1992), among others, found significant explanatory power of size and book-to-market ratio on stock returns. Their model was based on log market value of equity at the end of the last month and the book-to-market ratio at the end of the previous quarter as control variables. Accordingly, Fama and French stock beta estimate of the past 60-months return data was also included. Likewise, the past one-month returns were also included to control for the short-term reversal (Jegadeesh, 1990) as well as the past one-year stock returns to control for the momentum effect (Jegadeesh and Titman, 1993). They further added the previous quarter's ROE to control for the effect of earnings on stock returns. They found that the average coefficient for the change in the leverage ratio was negative and statistically significant at 1% level. The level of leverage ratio at the beginning of the previous quarter (LV_{t-1}) was included in the regression to control for the time–invariant effect of leverage as documented by Lemmon *et al.* (2008). But the results showed that quarterly leverage level was not related to stock returns. Intuitively, the information on the leverage ratio should already be incorporated into the stock price in an efficient market and, therefore, the market only reacts to innovation in the ratio.

Smith and Yamagata (2011) model takes into account different level of lagged return and lagged volatility, market sectors returns and volatility (using S&P500), business cycle and firm's characteristics. Whitelaw (1994) and others such Brandt and Kang (2004), Pesaran *et al.* (2004) and Dees *et al.* (2007) use the contemporaneous firm-level effect and particularly the change in firm's debt. Fama and French (1992) found significant impact of the change in the leverage ratio, while Lemmon *et al.* (2008) have added the lagged quarterly level of leverage ratio in their model. This support the idea about the importance of lagged debt in the econometric model.

We conclude that the model of Vanessa Smith and Takashi Yamagata (2011) ought to be used in combination with the models used by Whitelaw (1994), and Brandt and Kang (2004), Pesaran *et al.* (2004) and Dees *et al.* (2007) in order to take into account the change in debt used also by Jie Cai & Zhe Zhang (2011).

2.3. Approach for measuring contagion

An important feature of the selected approach is the measuring of causality in the frequency domain by discriminating contagion and interdependence, and taking into account the two factors: a permanent or long-run term and a transitory or short-run term.

Stronger linkages between the two returns (long- and short-term) could be due either to a higher co-movement between permanent components of returns, or to a higher co-movement between their short-run components. There will be contagion only in the latter case; contagion is therefore measured by a stronger linkage among the short-run components of the two returns after a crisis. In the former case, as the shift in cross-market linkages is permanent, what is measured is not shift-contagion but a higher integration of markets. Simply computing the correlations, even causality measures, without distinguishing between short- and long-run components will only provide spurious measures of contagion.

3. Methodology and data collection

This section explains the econometric models used for measuring returns and total volatility, and discusses at length the dynamic GMM analysis. The process of data selection and collection and issues arising are discussed here. This is followed by an overview explaining the list of variables used in the econometric models.

3.1. The econometric models for returns and volatility

- *Relationship between capital structure and the firm's level of debt:*

The econometric models, in line with the capital structure theory, use the capital structure ratio (debt over equity), whereas the *Islamic* stock screening is based on the level of debt (debt over total assets or the debt over capitalization). Therefore, we need to find the estimates between the two parameters using the GMM techniques applied to our time series as per the following:

$$\mathbf{Dit} = \alpha_{dit} + \lambda\mathrm{d}\ \mathbf{Dit-1} + + \beta\mathrm{d}1\, \boldsymbol{LV_t} + \beta\mathrm{d}2\ \mathrm{DMY} + \beta\mathrm{d}3\ \mathrm{DMY\ x}\ \mathbf{Dit-1} + \varepsilon_{it} \quad \mathbf{(1)}$$

Where:

D_{it}, D_{it-1}: Total debt divided by total equity (as capital structure) measured respectively at the end of quarter (*t*) and (*t-1*)

DMY is the dummy variable catching the threshold level of debt's effect:

If "debt to total assets" <= 0.33 then DMY = 1, otherwise, DMY = 0

The dummy variable is also used to catch the interaction effect between the level of debt and the capital structure.

- *The firm return equation*:

We extend the methodology of Vanessa Smith and Takashi Yamagata (2011) and combine Whitelaw (1994), Brandt and Kang (2004), Pesaran *et al.* (2004) and Dees *et al.* (2007).

$$r_{it} = \alpha_{it} + \emptyset_{11,i}\, r_{i,t-1} + \emptyset_{12,i} \log(\sigma_{i,t-1}) + \gamma_{11,i} \log(\sigma^{*}_{m,t}) + \gamma_{12,i} \log(\sigma^{*}_{m,t-1}) + \lambda 1\ \mathbf{Dit-1} + \mathrm{ExRate} + \mathrm{D2GDP} + \beta 1\ \mathrm{DMY} + \beta 2\ \mathrm{DMY} \times \mathbf{Dit-1} + \beta 3\ ROE_{it-1} + \varepsilon_{it} \qquad \textbf{(2)}$$

<u>Where</u>:

i,t:	Represent the firm *i* at the quarter *t*
α_{it}:	Is the intercept which is free to vary over time
r_{it} $r_{i,t-1}$	The share price return of the firm *i* at the quarter *t* and quarter (*t-1*)
$(\sigma_{i,t}), (\sigma_{i,t-1})$	Are systematic risk of the firm *i* at the quarter *t* and quarter (*t-1*)
$(\sigma^{*}_{m,t}), (\sigma^{*}_{m,t-1})$	Are systematic risk of the market m at the quarter *t* and quarter (*t-1*)

D_{it-1}:	Total debt divided by total equity (as capital structure) measured at the end of quarter (*t-1*)
DMY:	Is the dummy variable equal to 1 if theD2TASSETS ≤ 33%; otherwise zero
λ1:	The estimate coefficient of the lagged debt effect.
ROE_{it-1}:	Return on equity of the firm
ExRate:	The exchange rate for the currency of each country against USD
D2GDP:	The country level of debt over its GDP in percentage

We add exchange rate and country debt level to take into account of the currency and sovereign debt effects (ExRate + Sovereign Debt to GDP).

- The firm volatility equation:

$$\ln \sigma_{it} = \varphi_0 + \varphi_1 r_{i,t} + \varphi_2 r_{i,t-1} + \varphi_3 \ln \sigma_{i,t-1} + \psi_1 r^{*}_{i,t} + \psi_2 \ln \sigma^{*}_{i,t} + \psi_3 r^{*}_{i,t-1} + \psi_4 \ln \sigma^{*}_{i,t-1} + \lambda 2\ \mathbf{Dit-1} + \mathrm{ExRate} + \mathrm{D2GDP} + \beta 3\ \mathrm{DMY} + \beta 4\ \mathrm{DMY} \times \mathbf{Dit-1} + \beta 3\ ROE_{it-1}\ \upsilon_{\sigma\, it} \qquad \textbf{(3)}$$

The debt vector ($\mathbf{D_{it-1}}$) is added to the retained econometric model. We conclude that this model is helpful in enabling the inclusion of the vector of debt variable.

However, at this stage, we are not able to discuss the implications of the level of debt on the two components: returns and total volatility.

This study is focused on cross country analysis; thus, we use the same returns and volatility of the stock index of the country itself rather than the sector index. So, the variables with star represent the stock market of each studied country. We replace the firms' sector by the European stock index since we choose to capture volatility through all sectors, across different countries and, subsequently, with *Islamic* stock screening. So, $r^*_{i,t}$, σ^*_t, $r^*_{i,t-1}$ and $\sigma^*_{i,t-1}$ are the return and volatility and their lagged values of the European stock index.

The macroeconomic and financial market variables considered are those typically used in studies that examine the relation of business cycle variables with stock market such as Chen *et al*. (1986), Keim and Stambaugh (1986), Campbell (1987), Fama and French (1989), Fama (1990), Schwert (1989) and Glosten *et al.* (1993).

Our methodology uses the retained model as we intend to compute the estimates based on the Generalized Method of Moments (GMM) technique, suggested by Arellano and Bond (1991). GMM estimator is designed for situations with "small T, large N" panel data, with a few time periods and many individual firms (Roodman, 2006). This econometric methodology makes usage of lagged instruments of the endogenous variables for each time period to tackle possible endogeneity and joint determination of the explanatory variables in the panel.

The consistency of the GMM system hinges crucially on the lagged values of the explanatory variables to be a valid set of instruments, and for it not to be serially correlated. The study undertakes the difference Sargan test to establish the validity of the instrument set. A first order serial correlation test is performed to test whether the error term suffers from serial correlation. We should note that two-step GMM results are asymptotically more efficient estimates than one-step. The bias in the two-step standard errors are corrected by Windmeijer's (2005) correction procedure.

The construction of two-step GMM is different from one-step Baltagi's (2005) and Hayashi (2010). The one-step is equivalent to 2SLS (Cameron and Trivedi, 2005 - chapter 21). The two-step uses the consistent variance co-variance matrix from first-step GMM. The construction of the two-step and one-step GMM are different (both one- and two-step use different weighting matrices). It is likely that the estimates might be different. Typically either one or two-step is consistent, but the latter is more asymptotically efficient. Earlier researchers were making inferences from one-step standard errors since two-step standard errors were biased downwards. Not until recently with the introduction of Windmeijer's (2005) correction procedure that we saw researchers preferring to use two-step procedure.

The consistency of the GMM estimator depends on the soundness of the instruments. To address this issue, two specification tests suggested by Arellano and Bond (1991), Arellano and Bover (1995), Blundell and Bond (1998) are employed. The first specification test is the Sargan test (or Hansen J-test) for over-identifying restrictions, where the null hypothesis is the independence between the instruments and the error terms. The second specification test is the tests of serial correlations for error terms, where the null hypothesis is that there is no serial correlation.

Other advanced techniques will be used to analyze contagion effect of debt such as, Wavelet or mean variance efficient frontier.

3.2 Empirical data

The empirical data consists of portfolios of firms and stock indices of 10 major European countries including Germany, United Kingdom, France, etc. (the list of chosen Countries is based on their GDP ranking according to the World Bank, 2011).

We consider more than 6,800 corporations distributed over these ten countries, which effectively include the 100 largest firms per country. The chosen firm sectors are based on the classification of *Islamic* stock screening to make easier the second step of volatility analysis. Non-compliant sectors have been excluded such as banks, insurance, tobacco, financial services, etc. (for full list, see Table A1 in Appendix A) to ensure our country-level samples contain statistically significant number of *Islamic* stock companies. Data collection date has been done, at first, for 12 year period.

Quarterly data of firms are extracted from Datastream after having screened for market capitalisation and Islamic Dow Jones filter related to the debt ratio.

All parameters are in ratio form in order to work in percentage and proportions.

The time interval is from quarter 1, 2001 to quarter 1, 2013, effectively comprising 49 quarterly data with mean closing prices for the studied companies.

The time series of the selected firms (more than 1,200) and countries (10) are split into two groups based on the top most capitalization (or total assets). At the end of each fiscal quarter, we calculate for each firm the change in leverage during the quarter. We calculate leverage as the ratio between the book value of total debts (short and long term) and the book value of total assets.

3.3 Data selection for the econometric models

Table A2 in Appendix A, (breakdown of the retained firms in relation to their countries) contains the aggregated information on the number of firms that are selected based on a large number of firms (6,823 firms as initial total sample). The initial sample was filtered by excluding the missing values of the parameters (such as: total Equity =0, Total Assets=0 or Market Capitalisation = 0). Then from the filtered sample, we split it into High Debt (D2TASSETS > 0.33) and Low Debt (D2TASSETS <= 0.33) using the following ratio:

$$\text{D2TASSETS} = \text{Total Debts / Total Assets}$$

The sample is very small in the case of high debt firms and it is covering the three following countries: France, Netherlands and Poland (see table 1)

Table 1: Countries showing small samples based on 9 & 5 years

Country Name	Time span >= 9 years	Time span >= 5 years
France (FR)	8	20
Netherlands (NL)	5	10
Poland (PL)	0	9

Even for the time span of 5 years, we have only 9 firms for Poland and 10 for the Netherlands. This situation arises because we need to find firms that have "debt to total assets" more than 33% (*D2TASSETS > 0.33* called here the debt ratio threshold) in a consecutive manner. In other words, the cumulative "debt to total assets" for a firm should be in sequence, carrying out the debt ratio which is more than 33% during all the quarter of 9 years (or 5 years). We have overcome this issue by calculating the total debt of the current year over total assets for the same year (four quarters of one year rather than quarter by quarter). This may imply that the debt ratio for a specific quarter could be higher or lower than 33%, while the mean of the same ratio for the same year could be higher than the threshold.

By working on a yearly basis, we have to deal with the issue of duplicated data. In fact, a few firms have successive quarters throughout the studied period, above (or below) the debt ratio threshold. But the majority had debt ratios that were changing around the threshold.

Before using the yearly basis criteria, we attempted using the quarterly basis logic which had generated smaller samples.

On the other hand, there is no problem with getting a good sample for the low debt firms (D2TASSETS <= 0.33). The smallest sample comprised 19 firms from Spain during 9 years.

So, one of the two scenarios here could be considered:

1- Take all the 10 countries: small or big number of firms. But this will create unbalanced samples between countries (could be for 5 or 9 years).

2- or reduce the number of countries to the bigger samples by excluding Poland and the Netherlands. In this, case we will work only on 8 countries.

In all cases, the econometric models will comingle both high and low debt portfolios and to distinguish between the two, a dummy variable will be used for this purpose.

We decide to choose the second scenario because the samples of Poland and Netherlands are too small to be considered as significant.

3.4 List of variables used in the econometric Models

In the GMM specification, we need to determine whether a variable is "predetermined but not strictly exogenous". Therefore, we have classified the variables into the three following categories:

1- Category one is the case of variables that are "strictly exogenous",

2- Category two is the case of variables that are "endogenous",

3- Category three is the case of variables that are "predetermined but not strictly exogenous".

The table 2 gives the list of the variables used:

Table 2: List of used variables in the econometric model

Variable	Name and category of the variable	Var. Name	Level Name
1	ɸ = Debt/Equity = Debt-to-Equity ratio (As capital Structure) - Predetermined but not strictly exogenous	Cap Struct	Firm specific factors
2	Level of debt derived from Shari'ah screening is expressed as "debt to total assets" (D2TA) - Predetermined but not strictly exogenous	D2TA t−1	
3	ROE, Predetermined but not strictly exogenous	ROE t−1	
4	S & P stock index return for Europe - Strictly exogenous	SPEURO_R	Country specific factors
5	S & P stock index Volatility for Europe - Strictly exogenous	SPEURO_S	
6	Sovereign Debt/GDP, is strictly exogenous	d2gdp	
7	Local Currency over the US Dollar, is strictly exogenous	FOREX_Q	

Since market capitalisation is not available for three countries (Spain, Poland, Switzerland), we then use the weight for each firm based on the total asset of the sample.

However, inflation has not been taken into account because the cross-correlation between inflation and the return portfolio is very low (see the results based on wavelet coherence in ***section 4.3***).

4. Results and interpretation

This section starts by applying dynamic GMM to analyse the behaviour of low debt portfolio in comparison with high debt portfolio, each portfolio category comprising 160 firms, respectively distributed over eight European countries. Then, we analyse the risk-return profile using the MVEF for all countries under study. We proceed to focus on the UK as the biggest financial market in Europe by investigating the lead/lag relationship using wavelet coherence. This helps us discard some less influential variables in the panel analysis.

4.1. The presence of leverage effects and volatility feedback in European firms

This section discusses the estimation results from the econometric models presented in *section 3.1*. We start by discussing the relationship between "debt to equity" ratio and level of debt using the estimation results of the GMM (difference and system) model (1). We consider the long-run debt effects based on the return of the model (2) and based on the volatility of the model (3). The estimation results of the long-run effects of the country and stock index variables follow thereafter.

The two following techniques are applied: (i) Difference GMM, (ii) System GMM. Before deciding which results can be supported by theories and intuitions, we "experiment" by taking different "definitions" of a variable and/or add or drop the variables to test the "robustness" of results. Using the latest version of STATA software, we test the difference GMM before applying Windmeijer-corrected standard errors to take care of the first weakness of GMM. Subsequently, for taking care of the second weakness, we have considered the instrument proliferations (Roodman 2009b). We also use the "*collapse*" sub-option for the *xtabond2* command in STATA. This helps to reduce the number of instruments to be lower than the "size" of the sample. Finally, to ensure that the instruments are optimum, we check the diagnostics for consistency and serial correlation. Finally, the Arellano and Bond tests (AR1) and (AR2) are applied to examine the first and second order serial correlation in the differenced residuals. The failure to reject the null hypothesis for Sargan test (or Hansen J-test) and for

AR2 test indicates that the instruments used are valid (Yalta and Yalta, 2012**).** Robustness analysis on volatility and return models. In order to check the robustness of our results, we have conducted many tests (see Table 4, 5 and 6) and we present the most relevant ones in appendix C.

The retained more relevant statistical experiments conducted for dynamic panel data in the case of return and total volatility (Sigma) can been summarized in table 3 (see sections: 4.1.2. and 4.1.3.)

Table 3: Different Estimations/Options Applied for GMM	
Model Number	**GMM estimation with sub-options**
Model 1	One-step No Collapse
Model 2	One-step Robust No Collapse
Model 3	One-step Robust with Collapse sub-option
Model 4	Two-step robust with No Collapse sub-option
Model 5	Two-step robust with Collapse sub-option
Model 6	Two-step Robust No Collapse - Equation (level)

4.1.1. Relation between **"debt to equity" ratio** *and level of debt*

Table 4: Dynamic panel data estimators using GMM for the "debt to equity" ratio and the level of Debt

	One-step		**step No Inter. Du**		**One-step Robust**		**2-step No Robust**		**2-step + Robust**	
Capstruct	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
L1.Capstruct	**.7618***	28.9	**.6434***	22.6	.7618	1.70	**1.1113***	4069.6	**1.1113***	3.34
inter_dmy_d2ta	**4.8808***	8.3	/	/	4.8808	1.48	**-.1682***	-108.2	-.1682	-0.50
dmy_d2ta	**-6.219***	-9.1	**-15.027***	-15.7	-6.2192	-1.69	**.7490***	64.3	.7490	0.81
d2ta	**4.4079***	10.3	**15.5131***	16.6	4.4079	1.15	**1.3419***	65.6	1.3419	0.66
_cons	/	/	/	/	/	/	**-.9356***	-91.6	-.9356	-1.19
AR(1) { z then P>z }	-19.64	0.000	-17.84	0.018	-2.27	0.023	-1.87	0.061	-1.63	0.10
AR(2) { z then P>z }	-4.85	0.000	-7.8	0.386	-0.59	0.552	-0.54	0.592	-0.54	0.59
Sargan test { chi2 then P>chi2 }	4247.04	0.00	4072.7	0.00	4247.04	0.00	2956.1	0.00	2956.1	0.00
Hansen test { chi2 then P>chi2 }	/	/	135.5	0.003	216.49	0.000	190.08	0.00	190.1	0.00
GMM Hansen Ex. G. { chi2 then P > chi2 } [1]	3761.41	0.00	72.76	0.00	102.08	0.108	50.31	0.021	50.31	0.02
GMM Diff. (H0= exo.) { chi2 then P>chi2 } [2]	485.63	0.00	62.79	0.001	114.41	0.000	139.8	0.00	139.77	0.00
iv Hansen Ex. G. { chi2 then P > chi2 } [3]	1378.77	0.00	131.44	0.00	113.77	0.000	114.9	0.00	114.85	0.00
iv Difference (H0: Exo.) { chi2 then P > chi2 } [4]	2868.27	0.00	4.10	0.128	102.72	0.000	75.23	0.00	75.23	0.00

- ***(*) Estimators are computed with 95% Confidence Interval [p < 0.05]***

Difference-in-Hansen tests of exogeneity of instrument subsets:

[1] GMM instruments for levels - Hansen test excluding group

[2] GMM instruments for levels - Difference (null H = exogenous)

[3] iv(lnsigma_q nreturn_q L.ncapstruct inter_dmy_d2ta) - Hansen test excluding group
[4] iv(lnsigma_q nreturn_q L.ncapstruct inter_dmy_d2ta) - Difference (null H = exogenous)

Before presenting the results on returns and total volatility, we should look at the relation between "debt to equity" ratio ("*debt/equity*") and the level of debt ("debt to total assets"). The table 4 provides the dynamic panel data estimators using GMM for "debt to equity" ratio and the level of debt.

We should note that "debt to equity" ratio is impacted by both its lagged value and the level of debt ("debt to total assets"). Both estimates are statistically significant (see Table 4 for: "one-step" with and without the interactive dummy variable; "two-step not robust"). The estimate value related to the level of debt is equal to 4.4 in the case of "one-step" (first column in Table 4), 1.34 in the case of "Two-step no robust" (forth column in Table 4) and 15.5 in the case of "one-step with no interactive dummy variable" (second column in Table 4). Therefore, we conclude that there is a significant and strong long-run relation between the "debt to equity" ratio ("debt/equity") and the level of debt ("debt to total assets").

4.1.2. Long-run effect of Capital Structure and macro-economic variables on returns

Table 5 presents the long-run effect of the financial and macro-economic variables on firm returns using the retained econometric equation number 2.

The results that should be considered are the model 4 and model 6 (columns 4 and 6 in table 5). The model 5 (see column 5 in table 6) could not be considered because it is showing no significant correlation between the lagged volatility of the returns and the dependant variable.

Table 5: Dynamic panel data estimators using GMM for Returns versus "debt to equity" ratio

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Return_q	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
L1.Return_q	**-.3549***	-21.45	**-.3549***	-11.9	**-1.2399***	-10.0	**.2563***	6.6	1.2896	1.5	**.1378***	3.9
L1.LOG(Sigma_q)	**.0009***	12.46	**.0009***	5.2	**.0048***	8.8	**-.0015***	-15.9	-.0025	-0.7	-.0003	1.5
L1.Capstruct	4.17e-06	0.91	4.17e-06	0.8	-.0001	-1.6	**.00002***	4.1	**.0004***	3.1	**.00006***	3.7
inter_dmy_d2ta	**-.0007***	-7.39	**-.0007***	-3.6	**-.0055***	-2.6	**-.0002***	-2.1	**-.0160***	-2.4	**-.0016***	-3.9
dmy_d2ta	**.0009***	6.01	**.0009***	3.4	**.0093***	2.5	**.0007***	3.4	**.0287***	3.5	**.0027***	6.1
L1.nroe	6.44e-08	0.52	6.44e-08	0.4	**-6.26e-06***	-2.1	1.70e-07	1.5	4.16e-06	0.7	**8.49e-07***	3.7
d2gdp_q	-1.73e-06	-2.90	-1.73e-06	-1.4	**-.00001***	-2.1	1.14e-06	0.9	5.95e-06	0.2	1.18e-06	0.6
forex_q	**-.00001***	-2.01	-.0000	-0.6	-.0001	-0.4	**.00003***	2.5	.00003	0.1	9.43e-06	0.3
speuro_r	**1.1704***	39.99	**1.1705***	25.9	2.1148*	22.2	**.8127***	16.9	**.9005***	2.8	**.8246***	18.4
LOG(speuro_s)	.0001	2.50	.0001	1.9	.0005	1.9	.00005	0.6	.0006	0.7	**-.0004***	-3.8
L1. LOG(speuro_s)	**-.0009***	-13.16	**-.0009***	-6.9	**-9.19***	-9.2	**.0014***	15.5	.0035	1.2	**.0005***	4.0
_cons	/	/	/	/	/	/	.00001	0.0	-.0037	-0.7	**-.0017***	-3.7
AR(1)	-20.9	0.000	-9.5	0.000	-9.5	0.000	-9.5	0.000	-2.34	0.019	-9.08	0.000
AR(2)	-11.2	0.000	-6.5	0.000	-8.6	0.000	0.5	0.628	-0.19	0.847	0.792	0.792
Sargan test of overid	5995.6	0.00	5995.6	0.00	1.6	0.206	5282.6	0.000	79.9	0.00	4973.2	0.00
Hansen test of overid	/	/	307.6	0.001	/	/	302.9	0.002	37.8	0.00	37.8	0.002
GMM Hansen Ex. G. [1]	5540.1	0.00	276.8	0.00	1.6	0.206	258.7	0.00	12.3	0.00	269.8	0.00
GMM Diff. (H0= exo.) [2]	455.4	0.00	30.8	1.00	364.3	0.000	44.3	1.00	25.6	0.002	35.7	1.00
iv Hansen Ex. G. [3]	1305.3	0.00	301.1	0.001	11.9	0.103	297.6	0.003	4.33	0.741	299.1	0.002
iv Difference (H0: Exo.) [4]	4690.3	0.00	6.5	0.088	353.9	0.000	5.4	0.146	33.5	0.00	6.4	0.095

- (*) Estimators are computed with 95% Confidence Interval [p < 0.05]

The results show S&P European stock index returns to have a very strong long-run effect on firm returns. This may be explained by the fact that the return of the S&P European Index has effects on the Sentiment of Market Return or "investor sentiment". Therefore, the return of firms depends not only on fundamentals, but mainly on the market sentiment. A positive sentiment will drive positively the return on firms in general. Likewise, lagged firm returns have also a significant impact on firm returns.

We find a significant impact of both the lagged standard deviation of the return (negative correlation) and lagged volatility of the S&P European stock market returns (positive correlation). Hikes in lagged volatility of the S&P European stock market have a significant and detrimental effect on the European portfolios in the stock markets (See model 4 and model 6: column 4 “*2-step robust No collapse*” and column 6 “*2-step robust No collapse - EQ*”) while a sharp decrease in the lagged standard deviation of the return may push the returns of the portfolio to higher values.

From the model 4 (4^{th} column) in Table 5 (with the highest T-value for L1.CapStruct’s estimate), the relationship between the return and the lagged Capital Structure is as follows:

$$RETURN\_Q_{(q)} = \begin{cases} -2.28\ 10^{-4}\ L1.CapStrut, & if\ d2ta < 0.33 \\ +2.0\ 10^{-5}\ L1.CapStrut, & if\ d2ta\ \geq 0.33 \end{cases}$$

Also, “debt to equity” (Capital Structure) ratio combined with an interactive dummy variable is positively correlated with stock returns in the case of high debt portfolio (See 4^{th} column:

estimates of lagged "debt to equity" ratio equal to 0.00002 in the case of "debt to Total Assets", d2ta < 33% and equal to -0.000228 in the case of d2ta > 33% [2]) and negatively correlated with stock returns in the case of low debt portfolio. This is in line with the theory in the case of high debt, while it is going against the theory in the case of low debt. This means that, it is best to have the lowest "debt to equity" ratio when a firm is from a low debt category. Conversely, when a firm is from a high debt category, it is best to have the highest "debt to equity" ratio.
At the same time, the results show a negative effect of the exchange rate (domestic currency against US dollar) on stock returns (for the one-step, first column in Table 5, even if it is not the retained model). Decreases in the exchange rate (revaluation of domestic currency) depress aggregate stock prices by lowering the expected earnings.

4.1.3. The case of the volatility feedback and the leverage effects

To investigate the effect of level of debt on volatility, we run, in STATA, GMM equation of the retained econometric equation number 3. The GMM experiments, for the volatility analysis, have been conducted using the same models (Model 1 to model 6) adopted for the returns in the previous sub-section (4.1.2). This helps to keep a certain consistency between the two analyses. Table 6 reports the estimates of debt effect and lagged coefficient on econometric volatility of both high and low debts. The results suggest that volatility effect exists due to both: firm-level and market effects; and that lagged market volatility has a stronger impact compared to all other variables, namely market volatility effect (both contemporaneous and lagged are negatively correlated), market returns (contemporaneous is negatively correlated and lagged is positively correlated), "debt to equity" ratio, exchange rate and the lagged return of the firm. This finding is quite intuitive if we consider that it is the European market risk which is more difficult to avoid in the absence of international diversification outside the European market.

However, the sovereign debt seems not to have any statistical significant effect on volatility which is easily understood as the quarterly change in the sovereign debt has no effect on the volatility in the stock market. Intuitively the lagged idiosyncratic risk of a specific stock is expected to have a greater bearing on its own current volatility.

---

[2] Interaction effect exists between Capital structure (Cap Struct) and the level of debt (d2ta)

So, the interactive dummy variable Inter_dmy_d2ta is as follows: $\begin{cases} dmy\_d2ta = 1 \;\; if \;\; d2ta < 0.33 \\ and \\ dmy\_d2ta = 0 \;\; if \;\; d2ta \geq 0.33 \\ and \\ inter\_dmy\_d2ta = Cap\_Strut \;\; x \; dmy\_d2ta \end{cases}$

A noteworthy finding is the large negative contemporaneous and lagged market volatility effects which are strongly significant. The lagged firm-level volatility feedback effect is also negative and highly significant.

Turning to the lagged debt effects, we retain the model 3 ("One-Step Robust with Collapse sub-option") GMM estimation (see the 3rd column in Table 6) as it has one of the highest T-value for L1.CapStruct's estimate and the return is negatively correlated with the volatility[3].

By taking into account the interactive dummy variable (inter_dmy_d2ta), the relationship between the return and the lagged Capital Structure is as follows:

$$Log(SigmaN\_Q)_{(q)} is\ a\ function\ of \begin{cases} -0.8674\ L1.CapStrut, & if\ d2ta < 0.33 \\ +0.0402\ \ L1.CapStrut, & if\ d2ta\ \ \geq 0.33 \end{cases}$$

Table 6: Dynamic panel data estimators using GMM for the Sigma versus "debt to equity" ratio

[3] The "2-Step Robust No Collapse sub-option" estimation (see the 3rd column in Table 6) could not be retained since the CapStruct and the level of debt (d2ta) are negatively correlated in the case of high debt. This is going against the theory.

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
LOG(Sigma_q)	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
L1.LOG(Sigma_q)	.8008*	29.5	0.801*	34.4	0.6683*	7.2	1.0866*	46.4	1.3223*	14.1	1.208*	30.9
Return_q	.7807	0.2	0.781	0.1	-25.89	-1.8	11.395	1.9	18.665	1.6	.58859	0.1
L1.Return_q	-18.6*	-2.2	-18.66*	-2.6	-75.32*	-2.6	-48.53*	-4.2	-93.42*	-2.7	-70.11*	-5.3
L1.Capstruct	.0013	0.9	0.001	1.3	0.0402*	2.6	-0.0074*	-2.9*	.00181	0.2	-.0057*	-2.3
inter_dmy_d2ta	.1159*	3.7	0.116*	3.4	-0.908*	-2.8	0.2749*	3.7	-.0648	-0.3	.08876	1.9
dmy_d2ta	-.1204*	-2.3	-0.120*	-2.6	1.7404*	3.1	-0.464*	-5.7*	.18927	0.6	-.1480*	-2.3
L1.nroe	.0000	0.5	0.000	0.6	0.0009	1.7	-0.0001	-1.9	.00016	0.4	-.0000	-1.3
d2gdp_q	4.25e-06	0.0	0.000	0.0	-0.002	-1.1	-0.0006	-1.3	-.0009	-0.5	-.0005	-1.8
forex_q	.0060*	2.4	0.006*	2.8	0.0141	0.6	-0.0003	-0.1	.02321	0.8	-.0026	-0.8
speuro_r	-50.12*	-4.5	-50.13*	-4.5	114.67*	3.7	-87.33*	-6.5	-93.38*	-2.5	-46.36*	-3.2
L1.speuro_r	62.622*	6.1	62.62*	6.6	55.271	1.5	49.32*	3.7	4.6907	0.1	38.10*	2.7
LOG(speuro_s)	.3980*	21.3	0.398*	18.2	0.8676*	21.3	0.459*	16.5	.4399*	4.6	.4248*	13.8
L1. LOG(speuro_s)	-.2144*	-8.4	-0.214*	-9.0	-0.396*	-5.7	-0.487*	-16.8	-.7433*	-10.6	-.645*	-20.9
_cons	/	/	/	/	/	/	0.4652*	3.2	-.1828	-0.6	-.0812	-0.8
AR(1) { z then P>z }	-19.8	0.00	-10.86	0.000	-10.4	0.000	-10.9	0.000	-9.04	0.000	-10.78	0.00
AR(2) { z then P>z }	5.5	0.00	4.39	0.000	-0.22	0.825	4.5	0.000	4.03	0.000	4.74	0.00
Sargan test { chi2 then P>chi2 }	1482.6	0.00	1482.6	0.00	98.6	0.00	1817	0.000	264	0.00	1126.4	0.00
Hansen test { chi2 then P>chi2 }	/	/	298.1	0.002	/	/	299	0.003	133	0.00	295.08	0.005
GMM Hansen Ex. G. { chi2 then P>chi2 } [1]	468.2	0.00	256.9	0.00	2.59	0.108	264	0.00	0.56	0.455	258.2	0.00
GMM Diff. (H0= exo.) { chi2 then P>chi2 } [2]	1014.4	0.00	41.2	1.00	95.9	0.000	34.3	1.00	133	0.002	36.9	1.00
iv Hansen Ex. G. { chi2 then P>chi2 } [3]	671.9	0.00	292.6	0.002	60.7	0.000	288	0.007	45.7	0.000	284.8	0.009
iv Difference (H0: Exo.) { chi2 then P>chi2 } [4]	810.6	0.00	5.4	0.246	37.8	0.000	10.3	0.036	87.7	0.000	10.3	0.036

- (*) The estimators are computed with 95% Confidence Interval [p < 0.05]

the correlation is positive (its coefficient is equal to 0.0402376); on the contrary, the interactive dummy variable is negative (equal to -0.9076760) after transformation based on the relationship between "debt to equity" ratio and the level of debt – see the model 3 (3rd column in Table 6, "one-step robust with Collapse sub-option") and therefore is turning negative the value of the estimate (-0.8674). This means that for low debt firms (less than 33%), the higher the debt of the firm, the less volatile the share price in the European market. This is not in line with the theory and can be explained by the fact that low debt firms (having less than 33% in the LD portfolio) are generally smaller companies in markets. When a small firm increases its leverage while being lower than the threshold of 33%, the firm value will increase as the investors see on that a positive signal in the market. When a small firm increases its leverage while being lower than the threshold of 33%, the firm value will increase as the investors see on that a positive signal in the market. For instance an increase in the debt ratio of 1% will decrease the volatility with 0.45% and the return with 0.000228 % only. The latter is not that much high. More Importantly, since these are low-debt ratio firms (less than 33%), the investors may think that these firms are not high-risk takers and hence may look upon an increase in their debt ratio as a **'signal'** for their movement towards more investment and growth (by more borrowing) and so the volatility may decrease significantly although their return may not change significantly immediately.

4.2. Debt effect on portfolio behaviour using the Mean-Variance Efficient Frontier (MVEF)

Mean-variance theory formalizes the risk-reward profile and provides the necessary framework for advancing the understanding of investment management, including passive investing techniques. A logical first step in the formal analysis of portfolio selection is intuitively based on the choice of an optimal combination of risk and return which suits the need of the investors. For instance, at the same equal expected return, an investor will prefer the one with less variance to another with higher variance. An efficient portfolio has to satisfy the condition under which the investors will get the minimum of volatility with the maximum of expected return. The rate of return of the portfolio is expressed as the weighted average of returns of the individual stock return: $r_{it} = \sum_{j=1}^{p} (w_{jt}\, r_{i,t})$ and $\sum_{j=1}^{p} (w_{jt}) = 1$, where w_{jt} is the fraction of the portfolio value invested in asset j and p portfolio size. The correlation between each pair of stocks return should be computed, as it is required for calculating the volatility of the portfolio.

The variance of the portfolio is a function of the weights, variances and co-variances and can be expressed as a product of matrices: $\sigma_p^2 = w'.V.w$, where $\boldsymbol{V}$ is the variance-covariance matrix (Moriarty, 2001).

Matlab-based matrix computing is used to compute the MVEF for each studied portfolio. So, in order to analyse the portfolio's quarterly volatility and returns, we proceeded to use the expected returns and covariance matrices from the return time series.

For each asset the expected returns used in the model are calculated based on the average returns for that asset over the past 20 quarters. We assume this to be the correct long-run expected rate of return for each asset. In the same way that the expected returns are computed as the mean return for each asset over the past 20 quarters, the variance-covariance matrix is also calculated based on the asset returns over the same period of time (each quarter included in the five years period. The table of correspondence between the quarters Q1 to Q20 and their effective quarter expressed in the year is given in the appendix 1).

Our models show that based on historical data, the mean-variance model can show whether a portfolio with low debt firms has more profitable outcomes (in terms of volatility and returns) than a portfolio with high level of debt.

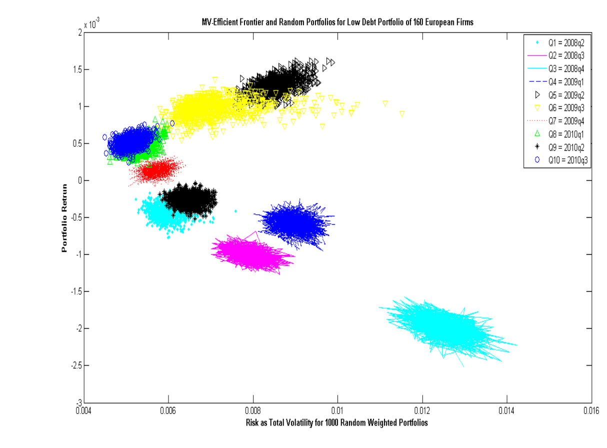
In this section, we are interested in analysing the debt effect on portfolios behaviour for 160 LD firms, 160 HD and the combined portfolio of 320 LD+HD firms. We consider three portfolios: (i) a portfolio of 160 firms with low debt - LD, (ii) a portfolio of 160 firms with high debt – HD and (iii) 320 firms as a combined portfolio of low and high debt (CD) portfolios detailed in (i) and (ii). We have computed randomly the risk-return profile of 1,000 possible portfolios for each strategy in which the assets are the same, only their weights are changing from one possible portfolio to another. The results of each quarter are represented in the form of a scatter plot or as a cluster of points.

Figures 1.a to 1.c display quarters Q1 to Q10 (respectively, Figures 1.d to 1.f display quarters Q11 to Q20). They show, respectively, the case of the individual and combined risk-return profiles for European portfolios strategies based on the MVEF as applied in the case of random weights for 160 HD + 160 LD firms.

Figure 1.a illustrates that during the GFC-2008, the combined 320-firms portfolio of high and low debt has a very large variation in volatility coupled with negative returns compared to the 160-firms portfolio of low debt for the same period (see Figure 1.d). This highlights the points that diversification is not helping during the period of the GFC-2008, whereas low debt offers more protection against volatility. Interestingly, a huge whipsaw is observed before and after the period of the GFC-2008.

However, quarter 3, 2008 (Q6) shows more dispersion in the low debt portfolio strategy (i) in terms of volatility without offering any noticeable better return than the combined portfolio; while the high debt portfolio strategy (ii) generates less volatility than the two previous ones. This may show that outside the period of the GFC-2008, portfolio with high debt could, sometimes, offer less volatility than one with low debt.

In most cases for the 20 studied quarters, low debt portfolios show less dispersion of volatility and outperform the high debt, while the combined portfolio display less volatility than the two other portfolios. More precisely, it was only 2 times (over 20) that HD portfolios have higher return than LD portfolios. 2 other times HD portfolios have barely higher (just very slightly higher) return than LD portfolios (See the graphs*:* **Figure 1.a** and **Figure 1.b;** then **Figure 1.h**).



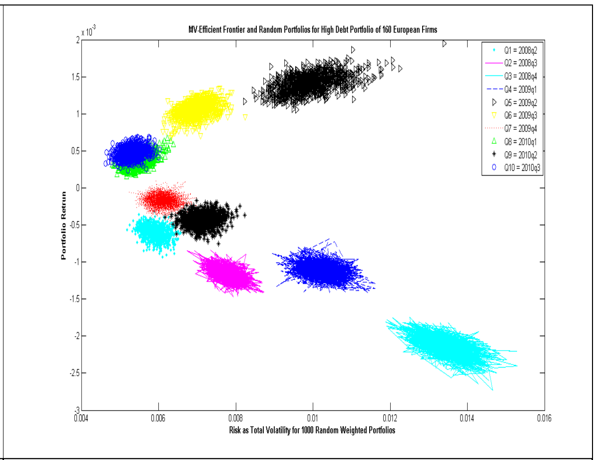


Figure 1.a – Low debt 160 firms, Q1 to Q10 | **Figure 1.b – High debt 160 firms, Q1 to Q10**

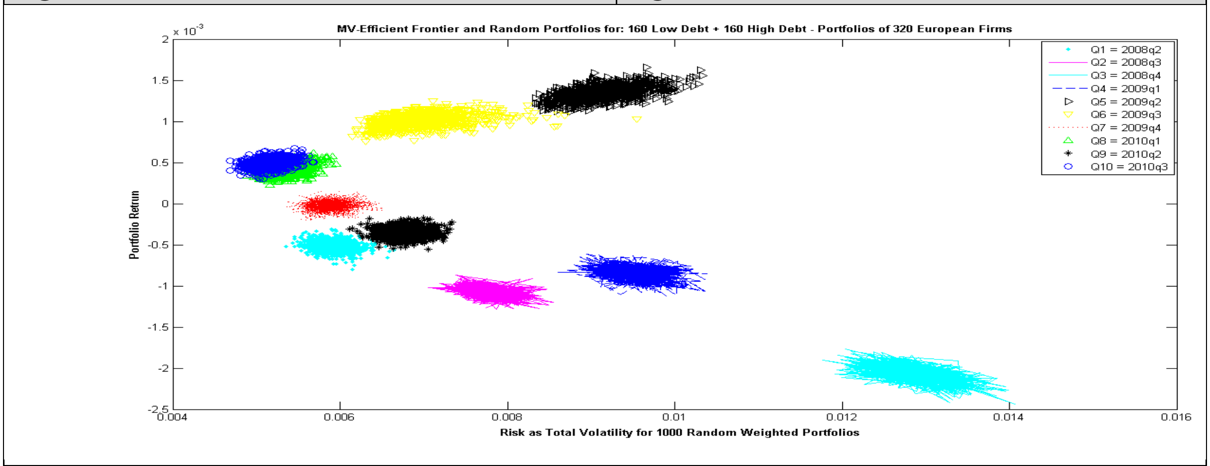
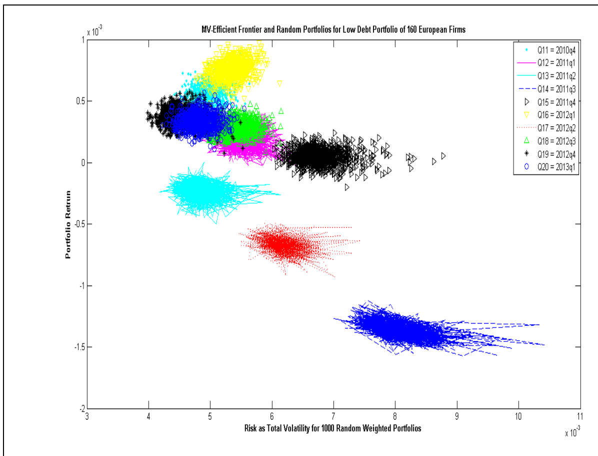


Figure 1.c - Risk-Return profile & Random Weight – combined 320 firms Portfolios Q1 to Q10

Yet, in the case of the combined portfolio, we are not able to conclude whether this result is due to the low debt effect or to the diversification effect. Therefore, an additional analysis is conducted below to elucidate this issue.



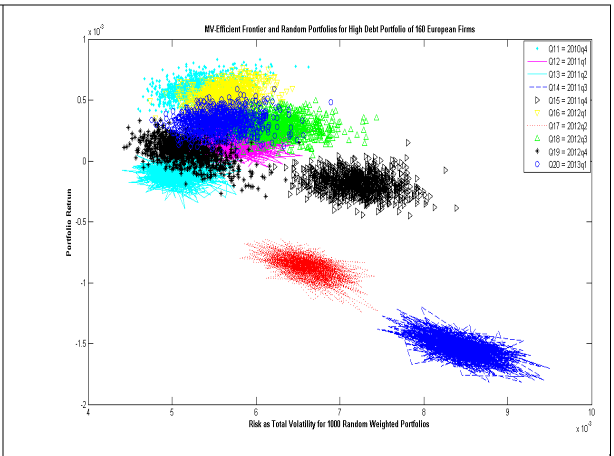


Figure 1.d – Low debt 160 firms, Q1 to Q10 | **Figure 1.e – High debt 160 firms, Q1 to Q10**

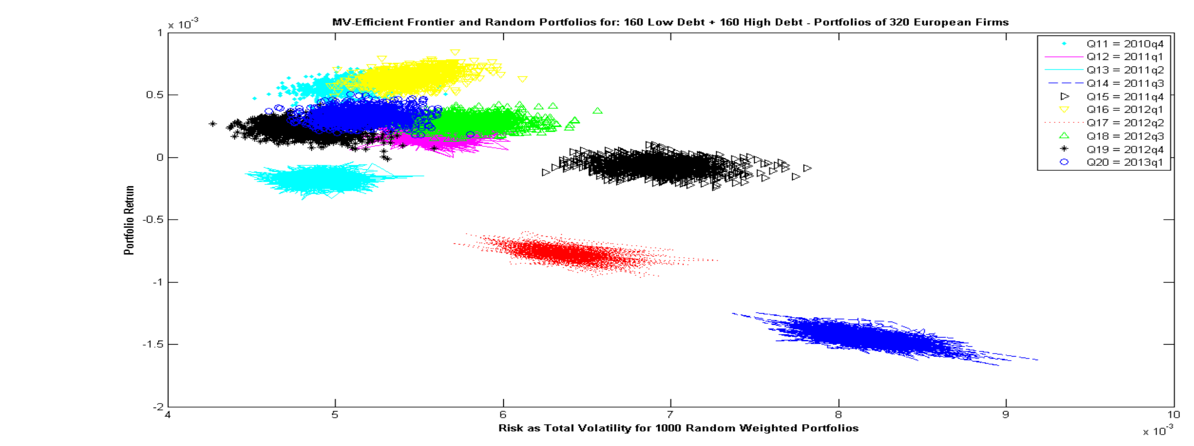


Figure 1.f - Risk-Return profile & Random Weight – combined 320 firms Portfolios Q11 to Q20

A comprehensive way to present the results above is to extract the centroid of each portfolio's scatter-gram for which we determine, for each quarter (Q1 to Q20), the risk-return values as the barycentre for all variations and disparities around each centroid.

Figure 1.g and Figure 1.h illustrate the volatility of the barycentre (respectively, the return of the barycentre) for each quarter (from Q1 to Q20). Figure 1.g shows three majors shocks happening on the quarters (Q3, Q9 and Q14) where the curves of the three portfolios in the three instances severely go up for volatility. The first time is during the GFC-2008, the second is during the beginning point of the Greek debt crisis (second quarter of 2010) and the third is during the severity peak of the European sovereign debt crisis (third quarter 2011). While the graphs are related to over-diversified[4] portfolios (160-firms of LD and HD, respectively, and 320-firms combined), they infer clearly that the LD debt strategy is slightly safer than the HD and CD strategy in terms of volatility during the whole studied period including during the three major shocks.

Regarding the debate between Johnson & Neave (1996) and Obaidullah (2006) on the location of the MVEF curve of compliant stocks (high risk versus low risk), we can clearly say that this curve shifts to the left in the case of low debt portfolio compared to high debt portfolio. This is in line with Obaidullah's hypothesis.

Figure 1.h shows that returns of the first strategy are higher for all the quarters except for Q1, Q5 and Q6 (quarter 2, 2008; quarter 2, 2009 and quarter 3, 2009).

[4] *Several portfolios LD, HD have been built with different number of equities sizes: 18, 36, 42, 80, 91, 92. A noticeable gap in returns between LD and HD has been observed.*

While we have considered the portfolios 160 LD and 160 HD, we noticed that this gap in returns between LD and HD has been drastically narrowed showing that the returns obtained were quasi the same for the 3 portfolios (160 LD,160 HD and 320 LD+HD). This allows us to talk about the over-diversification effect, because if we add more equities to those portfolio, the gap will be smaller but the new value will not be significant.

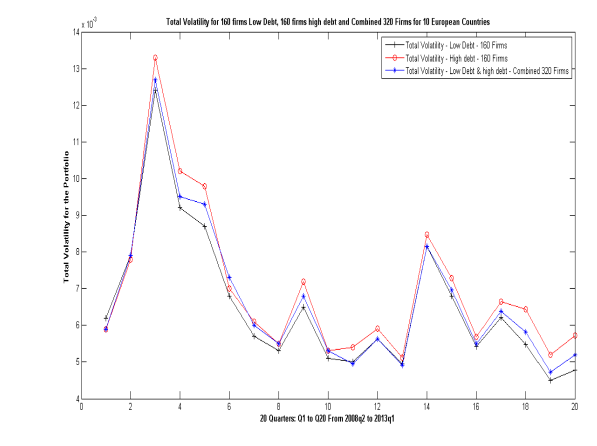


Figure 1.g – Sigma LD, HD & CD 320 firms, Q1

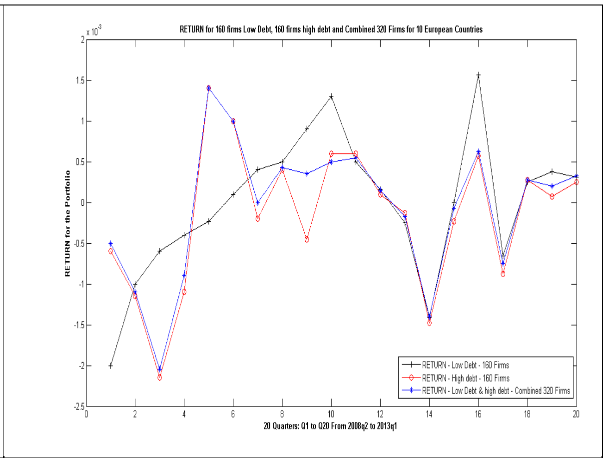


Figure 1.h – Return LD, HD & CD 320 firms,

A striking result is that during the three major shocks (Q3, Q9 and Q14), returns of LD was higher than HD and CD strategies. Interestingly, returns for LD jumped higher compared to HD and CD strategies just after each shock, with a lag of one to two quarters. This indicates that investors are more likely to move from HD to LD strategy (less financial risk) to seek for better asset quality known as "flight-to-quality" effect.

The presence of low volatility during shocks and their positive returns, even after financial shocks, demonstrates that the high losses may be due to the leverage effect and its link to financial risk. This is a revealing observation on the positive impact of low volatility on returns during and just after the shocks. For instance, the European sovereign debt and its political implications have generated "unnecessary risk" in the stock market. Wise investors should take into account both purely economic conditions and external factors by using international diversification in different markets and regions.

4.3. Lead-lag relationship between returns (volatility) and economic variables

This section investigates the cross-correlation between returns (and volatility) in relation to the following variables: the level of "debt to equity" ratio, the level of debt, the inflation, the sovereign debt, M2, the MSCI, the exchange rate (GBP to USD), the Libor, IP (Industrial index), S&P index (conventional and Islamic) and debt to equity. The rationale is to find variables impacting European portfolios' return and volatility.

We use the continuous wavelet transform coherence (*WTC*) based on paired variables to analyze the lead-lag relationship between the studied variables from two perspectives simultaneously - frequency domain and time domain. In this analysis, general conditions for strict stationarity have been relaxed. The wavelet coherence is employed below as our aim is to extract time-frequency features and, in particular, to capture localized intermittent periodicities.

While space does not permit a detailed examination of every country and all kinds of portfolios, this section highlights one important case of low debt portfolio in the UK capital market.

Points to note in Figures 5, 6 and 7:

- ➢ The 5% significance level against red noise is shown as a thick contour (black parabolic).
- ➢ The relative phase relationship is shown as pointing arrows:
- \- Right: in-phase; - Down: X leading Y by 90°; - Left: anti-phase; - Up: Y leading X by 90°.

➢ ***WTC for return & volatility versus inflation, sovereign debt, M2, Inflation, MSCI, exchange rate & Libor***

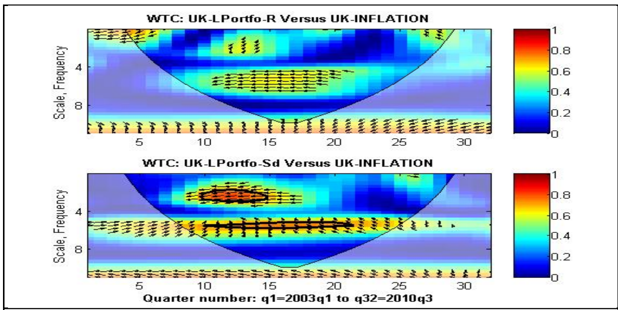


Figure 2.a - WTC: Return/Std – UK-Inflation

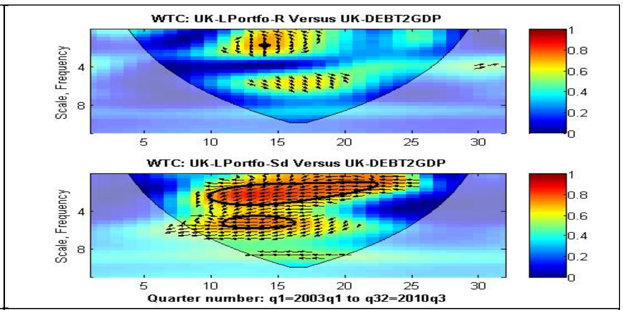


Figure 2.b - WTC: Return/Std – Sov. Debt

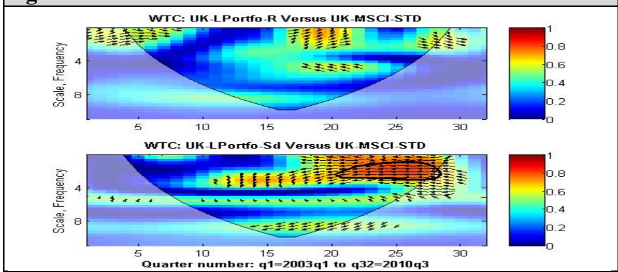


Figure 2.c - WTC: Return/Std – MSCI-std

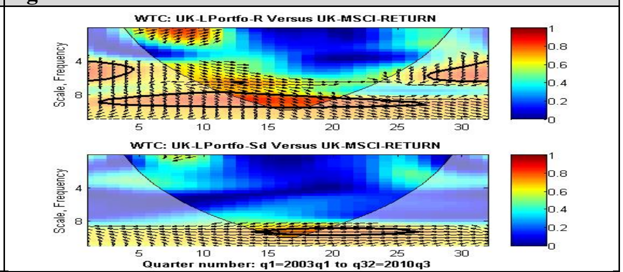


Figure 2.d - WTC: Return/Std – MSCI-Return

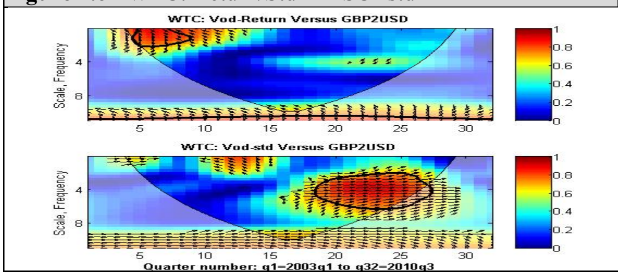


Figure 2.e - WTC: Return/Std – GBP_USD

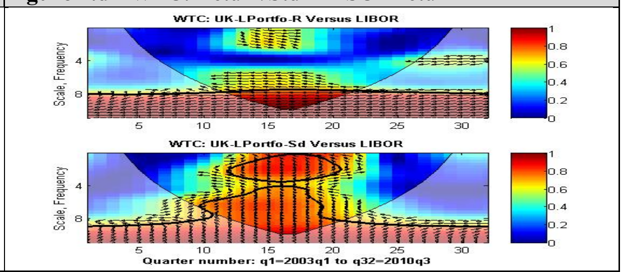


Figure 2.f - WTC: Return/Std – LIBOR

➢ ***WTC for return and volatility versus M2, IP, S&P conventional and Islamic***

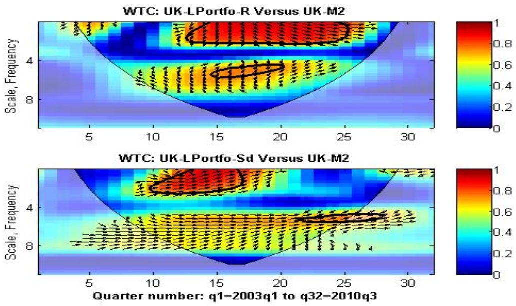


Figure 3.a – WTC: Return/Std – UK-M2

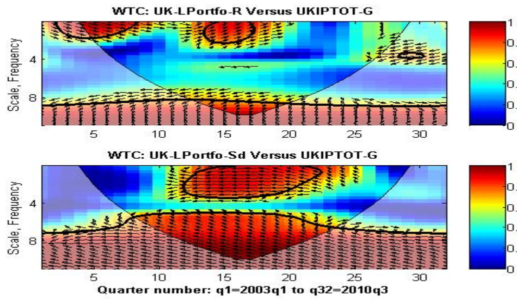


Figure 3.b - WTC: Return/Std – UK-IP

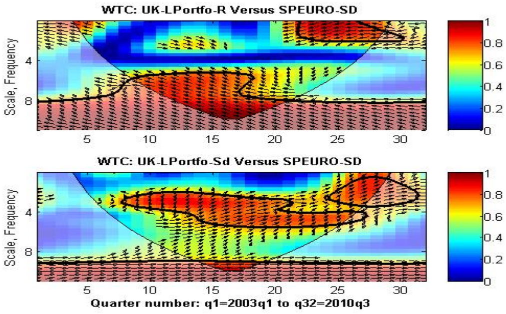


Figure 3.c - WTC: Return/Std S&P –Sd

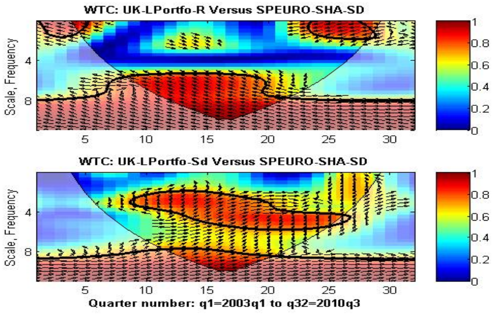


Figure 3.d - WTC: Return/Std – S&P –Sd - Islamic stock

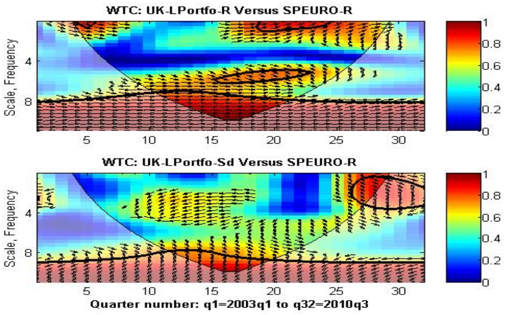


Figure 3.e – WTC: Return/Std S&P -Return

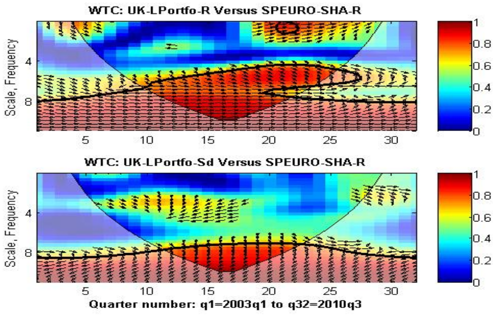


Figure 3.f WTC: Return/Std – S&P –R - Islamic stock

WTC for return and volatility (Std) versus debt to equity

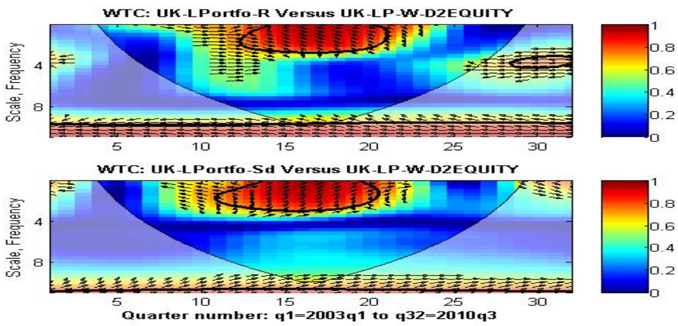


Figure 4 - WTC: Return/Std – W-Debt2 Equity

The WTC, applied to pairs of indices, renders information about the co-movement at different time-scales and, in particular, highlighting the impact at some specific events. Continuous wavelet transform, including cross-wavelet coherency, is applied to decompose daily returns and investigate correlations, co-movement, and lead-lag relationship in time-frequency space. In this study we begin by examining the UK firms (a portfolio of 18 UK firms in the case of low debt strategy) in terms of co-movement between its return and related parameters, as well as the correlation between the same parameters and the standard deviation of the same portfolio. Then, we analyze the respective high debt and low debt portfolios.

We can see from Figures 5 above, the absence of the lead/lag relationship in the case of the following pairs: the portfolio return versus UK Inflation (Figure 2.a), the portfolio return versus UK sovereign debt (Figure 2.b), the portfolio return versus the standard deviation of European MSCI Islamic (Figure 2.c) and the portfolio volatility versus MSCI Islamic Return (Figure 2.d). However, Figures 6 and 7 virtually show a clear indication of the degree of cross-correlations for both returns and volatility with the other analyzed parameters supporting the idea of co-movement and contagion in returns and volatility. (See above, Figure 3.a to 3.f and Figures 4.a, 4.b).

Case of the Portfolio Return/Volatility and the “debt to equity” ratio *(Debt/Equity):*

In Figure 4, the WTC plot for portfolio return and volatility versus leverage reveals two areas of high correlations in a specific period of time and different frequency-bands. Both the scale and positions of the components demonstrate good agreement at the two pairs. The arrows are pointing up (for the bigger area) and slanting towards the right showing a shift of lead-lag interactions between the two pairs.

It appears that leverage is leading returns and volatility during the GFC-2008. The main feature captured here is that the lead-lag relationship is not highly heterogeneous. Furthermore, the Portfolio Return/Volatility seems to be lagging behind leverage around scale 4 and for the data points around quarters 10 to 16. . This means that during the GFC-2008 the UK portfolios’ returns and sigma are interconnected with the level of debt and they change significantly in time and varies across the scale (short term frequency) of 2 quarters.

We can deduce that as a short-term response to the global economic shock, the return and volatility of portfolios were adjusting to both macroeconomic variables and firm-level “debt to equity” ratio. Thus, pointing out certain dependence of the return/volatility on the level of leverage.

Case of the Portfolio Return/Volatility and the Libor:

For returns and the Libor, in Figure 2.f, the modulus of the wavelet cross spectrum clearly demonstrates a strong component around scale 2 to 6. The magnitude of the component is generally strong over time. The Portfolio Return/Volatility is more likely to be non-sensitive outside the GFC-2008 period. But it clearly lags behind the Libor during the crisis. This means that investors should focus, in the short run (2 quarters), on the change in the Libor in the UK market. Therefore, regulator has a big role in influencing investors' risk appetite in the stock markets since he has the ability to oversight the LIBOR and plan changes to it.

It shows also, a high negative correlation zone indicating a clear co-movement between portfolio volatility and the Libor. This zone is precisely delimited between frequency-bands near 0 and near scale 8 and during the time between the 10th and 20th quarters (including 2008 and 2010). We can see that the Libor was leading portfolio volatility but measured lower in returns. This shows that the Libor was clearly driving the investor's policy in the UK market. As suggested by asset pricing theory, any positive change in the Libor was followed by a negative change in the portfolio return/volatility and vice-versa.

5. Concluding remarks and implications

Financial markets play a key role in the well-functioning or the mal-functioning of the real economy. Their instability can negatively impact not just the domestic but the global economy and lead to a kind of recession with nocuous implications on jobs and unemployment. While leverage is found to be linked to recessions and economic slumps, researchers are looking to new ideas to make the financial markets more stable and positive to the real economy. This is at the heart of the debate amongst economists, policy makers and politicians.

This research examined the leverage effect on returns and volatility of stocks and stock portfolios. From more than 6,000 European firms, 340 have been chosen based on the availability of needed data.

The findings show that (i) the firm's return and volatility change with changes in the capital structure, we examined two alternative levels of debt (less than 33% and more than 33%); (ii) the Islamic-compliant stocks, show (in most cases) less volatility than conventional stock but no different in terms of return; (iii) in terms of their risk-return profiles, Islamic compliant portfolios move to the left showing less volatility than the high debt portfolios. This feature is particularly present during the GFC-2008 period.

Dynamic GMM is used to correlate the firm's leverage (to total assets) with its returns and volatility. To ensure the robustness of results, the business cycle effects are considered by adding firm and the country characteristics. This also ensures that the heterogeneity across different firms and different markets are accounted for. Comparative portfolio analysis based on mean-variance efficient frontier (MVEF) is used to test the theory that a portfolio with higher “debt to equity” ratio has higher volatility and lower returns compared to that of a portfolio with lower “debt to equity” ratio. The Islamic stock screening threshold for debt is used.

We adopt a panel GMM framework which allows us to control simultaneously for country and firm characteristic effects, while taking into account the heterogeneity across firms. Our findings show a detrimental effect of the debt level on volatility of firms with high level of debt. However, it has a positive impact on volatility for firms with low level of debt (“debt to Total Assets” =< 33%). The LD portfolios are slightly safer than the HD and CD portfolios in terms of volatility during the whole studied period including during the major shocks.

In the presence of shocks, the firm’s debt level has a negative impact on returns and volatility for the case of the eight countries combined. Interestingly, since inflation is at historic lows, it has no impact on volatility and a very limited impact on returns. Most parameters have undergone the transmitted shocks due to the GFC of 2008.

The results of GMM analysis show strong evidence of a large negative effect of S&P European stock market index volatility (both contemporaneous and lagged), while sovereign debt, which is not significant, has no negative impact on returns and volatility at the firm-level. Overall, our findings are broadly consistent with capital structure theory, in which financial flexibility, plays an important role in the stability of the share price and volatility.

Finally, we used the continuous wavelet coherence transform (in the case of UK) to investigate the cross-correlation between returns (and volatility) for different stock-holding periods and different variables such as, the level of the debt (“debt to equity ratio”) and so on. This allowed us to analyse the lead-lag relationship between the studied variables.

We supported our analysis by investigating the lead/lag relationship between macro-economic and micro-economic variables in relation to returns and volatility by using the cross-correlation wavelet coherence technique.

We corroborated our study by analyzing the risk-profile portfolio in the European market using the MVEF. We show that the the mean variance efficient frontier tends to shift to the left in the case of low debt portfolios and to the right in the case of high debt portfolios. Remarkably, the low debt portfolio position is an efficient portfolio during the shock of GFC-2008. We can clearly conclude that the curve shifts to the left in the case of low debt portfolio compared to high debt portfolio. This is in line with Obaidullah’s hypothesis.

Policy implications:

There are two potential policy implications, (i) for policy makers, the detrimental impact of debt implies the need for some checks on excessive leveraging. The GFC of 2007 and other recent crises have shown the negative externalities of leveraging. There are huge social costs in addition to direct losses. As a start, regulators could reduce the tax benefit of debt over equity. This could be realised by reducing tax shield advantage (or even cancel it completely) when the firm's debt level goes above a certain threshold. The removal of the tax subsidy for debt also stands to potentially increase government revenue without much cost to the economy. (ii) At the investor-level, debt has a tax benefit to the firm while firm's risk is borne solely by the stockholders (Hamada, 1992). Higher leverage increases volatility and decreases returns which make the equity investment riskier. Investors may not participate in any new recapitalization of a listed firm if the latter is not able to reduce its leverage. Along the same lines, fund managers should be required to provide, periodically, information about the level of debt within their portfolios. Substantial changes in debt within portfolios alters its riskiness and the suitability of a portfolio to given investor risk profile or risk appetite. A final key implication of our results is the fact that the 33% debt threshold of Islamic finance has wisdom and involves no implicit cost to investors.

REFERENCES

Ahmad, W., Sehgal, S., Bhanumurthy, N.R., 2013. Eurozone crisis and BRIICKS stock markets: Contagion or market interdependence?. Economic Modelling 33, 209–225.

Aloui, C., Nguyen, D. K. and Njeh, H. (2012). Assessing the Impacts of Oil Price Fluctuations on Stock Returns in Emerging Markets. Economic Modelling. 29(6), 2686 - 2695.

Aloui, R., Ben Aissa, M. S., and Nguyen, D. K. (2011). Global Financial Crisis, Extreme Interdependences, and Contagion Effects: The Role of Economic Structure? Journal of Banking and Finance 35(1), 130– 141.

Bae, K. H., Karolyi, G. A., & Stulz, R. M. (2003). A new approach to measuring financial contagion. *Review of Financial studies*, *16*(3), 717-763.

Benhmad, F., 2013. Bull or bear markets: A wavelet dynamic correlation perspective. Economic Modelling 32, 576–591.

Billio M. & Caporin M. (2010). "Market linkages, variance spillovers, and correlation stability: Empirical evidence of financial contagion", Computational Statistics & Data Analysis, v.54 n.11, p.2443-2458, November, 2010 [doi>10.1016/j.csda.2009.03.018]

Bodart and Candelon, 2009. Evidences of interdependence and contagion using a frequency domain framework. Emerg. Mark. Rev. v10. 140-150.

Corsetti, G., Pericoli, M., Sbracia, M., 2001. Correlation analysis of financial contagion: what one should know before running a test. Banca d I talia Temi di Discussione No. 408.

Corsetti G., Pericoli M. and Sbracia M.,2005. Some contagion, some interdependence: more pitfalls in tests of financial contagion. J. Int. Money Fin. v24. 1177-1199.

Dewandaru, G., Masih, R. and Masih, A. M. M. (2016), What Can Wavelets Unveil About the Vulnerabilities of Monetary Integration? A Tale of Eurozone Stock Markets, *Economic Modelling*, 52, 981 -996.

Duncan, A. S. and Kabundi, A. (2013). Domestic and Foreign Sources of Volatility Spillover to South African Asset Classes. Economic Modelling. 31, 566- 573.

Dornbusch R., Park Y. C., Claessens S., 2000. Contagion: understanding how it spreads. World Bank Res. Obs. v15. 177-197.

Engsted and Tanggaard, 2004. The comovement of US and UK stock markets. European Financ. Manage. v10. 593-607.

Forbes and Rigobon, 2002. No contagion, only interdependence: measuring stock markets comovements. J. Financ. v57. 2223-2261.

Gallo, G. M., & Otranto, E. (2008). Volatility spillovers, interdependence and comovements: A Markov Switching approach. *Computational Statistics & Data Analysis*, *52*(6), 3011-3026.

Gencay R, Selcuk F and Whitcher B., 2005. Multiscaling systematic risk. J. Int. Money Financ. v24. 55-70.

Hamada, R. S. (1972). The effect of the firm's capital structure on the systematic risk of common stocks. *The Journal of Finance*, *27*(2), 435-452.

Hwang, E. Min, H-G. Kim, B-H. and K, H. (2013). Determinants of Stock Market Comovements among US and Emerging Economies during the US Financial Crisis. Economic Modelling. 35, 338- 348.

Hyun-Seok Kim, Hong-Ghi Min, Judith A. McDonald. Returns, correlations, and volatilities in equity markets: Evidence from six OECD countries during the US financial crisis. Economic Modelling, Pages 9-22

Kaminsky and Reinhart, 2000. On crises, contagion, and confusion. J. Int. Econom. v51. 145-168.

Longin and Solnik, 1995. Is the correlation in international equity returns constant: 1960-1990?. J. Int. Money Finance. v14. 3-26.

Mensi, W., Beljid, M., Boubaker, A. and Managi, S. (2013). Correlations and Volatility Spillover across Commodity and Stock Markets: Linking Energies, Food and Gold. Economic Modelling. 32, 15-22.

Smith, W. S., & Conover, J. A. (1993). Risk and the miller equilibrium: Capital structure choice with risk-averse investors. *Review of Quantitative Finance and Accounting*, *3*(3), 367-382.

Tiwari, A. K., Mutascu, M., & Andries, A. M. (2013). Decomposing time-frequency relationship between producer price and consumer price indices in Romania through wavelet analysis. *Economic Modelling*, *31*, 151-159.

Percival and Walden, 2000. Wavelet Methods for Time Series Analysis. Cambridge University Press, Cambridge, UK.

Pericoli and Sbracia, 2003. A primer on financial contagion. J. Econom. Sur. v17. 571-608.

Rodriguez, 2007. Measuring financial contagion: a copula approach. J. Empir. Finance. v14. 401-423.

Tiwari, A.K., Mutascu, M., Andries, A.M., 2013a. Decomposing time-frequency relationship between producer price and consumer price indices in Romania through wavelet analysis. Economic Modelling 31, 151–159.

~~~~~~~%~~~~~~~
~~~~~~~

Appendix A.

Table A1: List of sectors (Excluded and Included)	Status
Banks, Beverages, Equity Investment Instruments, Equity Warrants, Financial Services, Fixed Line Telecommunications, Food and Drug Retailers, Food Producers, Leisure Goods, Life Insurance, Media, Non-Equity Investment Instruments, Nonlife Insurance, Other Equities, Other Warrants, Real Estate Investment and Services, Real Estate Investment Trusts, Suspended Equities, Tobacco, Travel and Leisure, Unclassified, Unquoted equities.	Excluded
Aerospace and Defence, Alternative Energy, Automobiles and Parts, Chemicals, Construction and Materials, Electricity, Electronic and Electrical Equipment, Fixed Line Telecommunications, Forestry and Paper, Gas, Water and Multi-utilities, General Industrials, General Retailers, Health Care Equipment and Services, Household Goods and Home Construction, Industrial Engineering, Industrial Metals and Mining, Industrial Transportation, Mining, Mobile Telecommunications, Oil and Gas Producers, Oil Equipment and Services, Personal Goods, Pharmaceuticals and Biotechnology, Software and Computer Services, Support Services, Technology Hardware and Equipment.	Included

-) Breakdown of retained firms in relation to their countries

Table A2: Aggregated information regarding the number of retained European firms

				High DEBT			Low DEBT				Combined portfolios	
INITIAL TOTAL SAMPLE		Filtred Sample		>=9 Y	>= 5 Y	< 5 Y	>=9 Y	>= 5 Y	< 5 Y		>=9 Y	>= 5 Y
AUSTRIA	132	116	AU	11	32	31	27	57	40	AU	38	89
FRANCE	856	74	FR	8	19	23	34	49	18	FR	42	68
GERMANY	1172	455	GM	35	90	126	177	279	108	GM	212	369
ITALY	364	99	IT	25	51	25	31	55	29	IT	56	106
NETHERLAND	219	98	NL	5	10	50	51	82	7	NL	56	92
POLAND	637	68	PL	0	9	17	33	61	6	PL	33	70
SPAIN	216	75	SP	16	44	16	19	35	28	SP	35	79
SWEDEN	804	102	SD	11	26	25	46	63	22	SD	57	89
SWITZERLAND	412	120	SW	5	19	24	64	97	19	SW	69	116
UK	2011	142	UK	10	22	41	76	114	16	UK	86	136
	6823	ALL Countries		126	322		558	892			684	1214

Appendix B.

Table B1: List of used variables in Stata

Nb	Model Variables	Definition of the variables in GMM estimations
1	**Return_q**	Quarterly return
2	**L1.Return_q**	Lagged return
3	**LOG(Sigma_q)**	Quarterly Sigma or volatility
4	**L1.LOG(Sigma_q)**	Lagged Sigma
5	**L1.Capstruct**	Quarterly lagged Capital Structure
6	**inter_dmy_d2ta**	Dummy variable related to debt to total assets
7	**dmy_d2ta**	Dummy variable related to debt to total assets
8	**L1.nroe**	Lagged ROE
9	**d2gdp_q**	Quarterly sovereign debt to total GDP
10	**forex_q**	Exchange rate of the country related to the US$
11	**speuro_r**	S&P European Return
12	**LOG(speuro_s)**	Log of S&P European Sigma
13	**L1.LOG(speuro_s)**	Quarterly lagged Log of S&P European Sigma

Appendix C.

Robustness analysis on volatility and return models

Finally, in order to check the robustness of our results, we have conducted many tests and we present here the most relevant ones (see Table 4, 5 and 6). We have examined 340 firms in eight countries based on data availability. For the Arellano and Bond tests (AR1) and (AR2), the failure to reject the null hypothesis for Sargan test (or Hansen J-test) and AR2 test indicates that the instruments used are valid (Yalta and Yalta, 2012**).** That is the case of the retained scenarios: "*one-step robust with no interactive dummy variable*" for the relationship between the "debt to equity" ratio and the level of debt-based total assets (see table 4), "*two-step robust with collapse sub-option*" for the return model (see table 5) and "*one-step robust with collapse sub-option*" for the volatility model (see table 6).

Furthermore, since the time series observations are relatively large, the autoregressive parameter is below 0.8 for volatility and given the relationship between "debt to equity" ratio and the level of debt-based total assets (one-step robust with no interactive dummy variable 2nd Column in table 4), suggests that the 'System GMM' is not necessarily superior to the 'Standard GMM' (Blundell and Bond, 1998, Moshirian and Wu, 2012) which is in line with our findings. However, that is not the case for the return model since the coefficient of autoregressive parameter is above 0.8 (= 1.289) for 'System GMM'-robust with collapse sub-option". Overall, our statistical results are similar for most of the experiments suggesting that the nature of the above reported findings is more or less robust.

Appendix D.

AAOIFI – *Shari'ah* standards Number (21) – 3/4/2 Rules for dealing with shares and bonds

3/4/2 That the collective amount raised as loan on interest – whether long-term or short-term debt – does not exceed 30% of the market capitalization of the corporation, knowingly that raising loans on interest is prohibited whatsoever the amount is.