Leverage, Sensitivity to Market Risk and Contagion: A Multi-Country Analysis for Shari'ah(Islamic) Stock Screening

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Abstract

This study is the first attempt to investigate the relationship between firm's leverage and systematic risk for seven European countries in relation to *Shari'ah (Islamic)* stock screening. This paper also aims to examine the shock transmission through the systematic risk and whether less debt could bring more stability to the capital market. Using a dynamic panel technique based on VAR (Vector autoregressive) and dynamic GMM framework, we analyse the levered and the unlevered beta of the firm based on the firm characteristics before adding the country characteristic effects in order to take into account the heterogeneity across firms, which ensures the robustness of the results. We find that leverage is significantly and positively associated with systematic risk and that high leverage augments systematic risk, which is more affected by the nature of the European market rather than the firm characteristic effect. However, the existence of high leverage is indicative of having a big role in making worse the firm conditions under shocks. The presence of these effects is further explored through the responses of the model's variables to market-wide volatility and shocks. Finally, the sensitivity to the market appears to be impacted by the financial crisis in terms of contagion in leverage with implications for portfolio diversification. Our findings have implications on the stability of firm's risk exposure and the appropriate level of debt's commitment to be made by managers.

Keywords: sensitivity to the market or systematic risk, leverage, dynamic GMM panel technique, financial crisis, contagion, *Shari'ah* stock screening

1. Introduction

Risk is of paramount importance to any discussion about the value of the firm. Financial theory is advocating that "the goal of the firm is to maximize value and thus firms configure their balance sheets to achieve this goal" (**Duett et al., 1996**). Furthermore, analysing the relationship between the leverage and systematic risk is justified because the latter have a direct effect on the share valuation in the stock market. At the same time, the perception of the investors about risk is directly influencing their investment decision process (**March & Shapiro, 1987; Weber, 2004**). In particular, increasing debt increases leverage and increasing leverage increases beta. There is a trade-off between the level of debt and equity to have a systematic risk as low as possible. It would be of great importance for the firm to determine the optimum level of debt since stocks that drop dramatically when the market falls are those with high betas(**Goetzmann et al. 2005**).

However, there is no consensus in the existing literature regarding the level of impact of leverage over the systematic risk beta for the firms. According to the theory, systematic risk will increase with the increase of a firm's debt; in general they are correlated positively. Regarding the systematic risk (beta) with its both components: Financial risk and business risk, a considerable research has focused on the capital structure and its relation to the systematic risk with mixed results.

To the best of our knowledge, only very few studies have focused on the issue of relationship between the capital structure and the sensitivity to market risk within the Islamic Finance framework by applying the stock screening filters (quantitative and qualitative).

In this study, we aim to investigate whether the systematic risk (β) changes with the changes in the capital structure of the firm in both cases: high debt and low debt firms within seven European countries. Firms having a capital structure less than 33% are respecting the first *Shari'ah* screening criteria and will be a good candidate to be considered as compliant Stock.[1]

In particular, we focus on three objectives: (i) Measuring the impact of the leverage on the systematic risk (known also as sensitivity to market risk) based on empirical evidence; (ii) analysing this impact during the Global financial crisis since we are expecting it to be amplified; and (iii) providing empirical evidence on how *Shari'ah* stock screening could bring more stability to the capital market and therefore this study intends to fill the gap by analyzing the impact of the Firm's debt in corporate financing on the systematic risk and contagion.

The paper is using the recent advanced techniques related to panel techniques based on dynamic GMM: Generalized Method of moments (both difference and system). To make our model robust, we have added to the model a set of variables related to firm characteristics and two other variables related to the country level: the exchange rate and the sovereign debt. We are also using continuous wavelet based levered and unlevered betas to analysis indirectly the impact of financial risk (beta debt) during the financial crisis.

The remainder of the paper is arranged as follows: section 2 presents the literature review, section 3 reports the research methodology of the study and data collection, section 4 discusses the results and lastly the section 5 concludes and provides policy implications.

2. Literature review

Measuring systematic risk is related to the work on basic portfolio model Markowitz (1952, 1959) and the capital asset pricing model by Sharpe (1963, 1964) using average β's of the stocks comprised in the portfolio. In addition to that, common stock risk was also classified into two components: the systematic risk (unavoidable risk) and the unsystematic risk (avoidable through diversification).

There is a considerable body of literature on the sensitivity to market risk. We discuss below the salient research related to impact of the leverage on the systematic risk.

Numerous studies focused on the between beta (β) and single or various financial policy variables. Hamada (1972) identified firm's capital structure to have a significant effect on the common stock β. He found that leverage can be used to explain 21 to 24 percent value of the common stock β. Lev (1974) discovered an empirical relationship between firm's operating leverage and the market β. Ben-Zion and Shalit (1975) found firm size, leverage and other variables to be the significant determinants of firm's β. Similarly, Castagna and Matolcsy (1978) supported debt-to-equity ratio, debt-to-total assets ratio, EBIT-to-total assets ratio, interest coverage and other firm varaiables to bear significant correlations with the systematic risk.

Engle and Ng and others (1993), reported that conditional volatility of stock returns to be 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 can be transmitted through the variance asymmetry channel.

Jie Cai & Zhe Zhang (2011) have 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). They have examined whether the observed negative relation between leverage changes and stock returns reflects these stocks' different cross-sectional loadings on systematic risk factors. They have obtained the return series of these factors and the one-month T-bill yield from Kenneth French's website. The alphas from the regressions represent the risk-adjusted returns of the portfolios. They expected the alphas to be similar across all the portfolios. Although the factor models cannot explain the negative relation between changes in leverage ratio and next-quarter stock returns, a firm's capital structure choice may depend on other firm characteristics not captured by these factors.

The purpose of this study is to analyze the impact of leverage on the systematic risk of common stocks of European firms within seven European countries with a specific focus on the period of the GFC (Global financial crisis 2008). Investigate the impact of level of the debt suggested by the Shari'ah stock screening may decrease the values of systematic risk of common stocks and could be useful to financial managers and investors who seek to invest in firms with lower values of beta.

3. Methodology and data collection

3.1. The econometric models for systematic risk

Following Kingsley ***O. Olibe et al.*** (2008), we adopt the following model

$$\beta_{it} = \alpha_{it} + a\,\beta_{it-1} + \lambda_{t,i}\ D_{it-1} + £_{t,i}\left(\frac{\text{SALES}}{\text{ASSETS}}\right) + \varphi_{i,t}\ MTBit + \psi\ \text{MarketCap} + ROE_{it-1} + \text{ExRate} + \text{D2GDP} + \beta1\ \text{DMY} + \beta2\ \text{DMY x}\ D_{it-1} + \gamma_{t,i}\ \ln SIZE_{it} + \varepsilon_{it} \quad \textbf{(1)}$$

Where:

β_{it} : Systematic risk of the firm

LEVit total debt divided by total assets both measured at the end of quarter t.

MTB_{it} market-to-book value for firm i at time t will be replaced by "Price to Book Value"

SIZE The weight of the firm based on the size of the sample using total assets for firm i at time t.

Replacing the *FATA* variable by $\left(\frac{\text{SALES}}{\text{ASSETS}}\right)$, because the sales could be a proxy for international exports; *FATA* was the degree of international diversification defined as foreign assets scaled by total assets.

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

Our methodology is based on the Dynamic GMM (both difference and system) that we have applied with the help of the latest STATA software.

We compute the quarterly β_{it} by using daily stock market return and the market stock index for each quarter, where the firm is listed, as follows: $\beta_{it} = \frac{Covar\,(r_{it}, r_{m,t})}{Var\,(r_{m,t})}$ (2)

This will provide us, for each firm with a time series of total beta for the same period of time.

The beta portfolio will computed based on the following formula: $\beta_{ip} = \Sigma\, w_{i,t}\beta_{it}$

However, there are two limitations pertaining to the use of variance: (i) the asymmetry is not well captured by the variance (co-variance) and the asymmetric distributions variance might not be a good measure.

3.2. List of variables used in the econometric Models

The table below gives the list of used variable:

Table 1: List of variables

Variable Id	Name and category of the variable	Var. Name Level Name
1	Beta as systematic risk	β
2	Capital Structure (Debt/Equity)	ϕ = Dit-1
3	Local Currency over the US Dollar	FOREX_Q
4	ROE Rate of Return	ROE t−1
5	Size as the weight of the firm within the sample based total assets	w
6	Sovereign Debt/GDP.	d2gdp
7	Sales over Total Assets	S2TA = Sales/ASSETS
8	Price to Book Value	Price2BV
9	Market Capitalisation	MarketCap

We have opted for the unbalanced data because the Market Cap and the Price to book value are not available for all the firms and all the countries. Besides that, to get a clear view about the impact of each firm based on its size within the sample, we have used the weight for each firm based on the total asset related to the total of the sample.

3.3. The Financial risk versus business risk or beta components

The Financial risk versus business risk or beta components are given in the equation below making a separation between the levered and unlevered betas for a firm:

$$\boldsymbol{\beta_{L,t+1} = \beta_{a,t+1}\ [1 + (1 - T)\,\frac{D_t}{E_t}\,]} \qquad \textbf{(3)}$$

where: β_L = Levered beta for the equity in the firm

β_a = Unlevered beta of the firm (i.e., the beta of the firm without any debt)

T = Marginal tax rate

$\frac{D_t}{E_t} = \boldsymbol{\phi}$, Debt-to-Equity ratio (market value)

Based on the equation (3), we derive the following equation:

$$\boldsymbol{\beta_{a,t+1}} = \left(\frac{\boldsymbol{\beta_{L,t+1}}}{(1+\lambda\, \phi)} \right) \qquad \textbf{(5)}$$

$$\text{Where } \phi = \frac{D_t}{E_t} \text{ and } \lambda = (1 - T)$$

We can notice that this model shows a positive correlation between the two betas ($\beta_{a,t+1}$ and $\beta_{L,t+1}$). A simplified formula of levered beta which is called Practioners's model (Ruback 1995; Fernadez 2003) is using only the capital structure and is given as follows:

$$\boldsymbol{\beta_{a,t+1}} = \left(\frac{\boldsymbol{\beta_{L,t+1}}}{(1+\ \phi)} \right) \qquad \textbf{(5.1)}$$

In this model, the obtained levered beta will be higher than the Damodaran formula becauyse the term (1 – T) has been removed. This model will not be used in this study.

Zolotov & Kalev (2012) have used a model taking into account the $\boldsymbol{\beta_{d,t+1}}$ (beta debt). It was based on a multivariate generalization of Hamada's (1972) formula for levered CAPM beta. It shows that Hamada's (1972) result can be extended to any linear factor model and, in particular, to the Fama–French three-factor model.

$$\boldsymbol{\beta_{e,t+1}} = \boldsymbol{\beta_{a,t+1}} + (\boldsymbol{\beta_{a,t+1}} - \boldsymbol{\beta_{d,t+1}})\, \frac{\boldsymbol{D_t}}{\boldsymbol{E_t}}\, (\boldsymbol{1 - T}) \qquad \textbf{(4)}$$

Where $\boldsymbol{\beta_{d,t+1}}$ is beta related to the debt of the firm.

This relationship is valid only for a company that maintains a fixed book-value leverage ratio (Fernández, 2004). It is assuming that the unlevered beta is always higher than beta debt; consequently, the levered beta is higher than beta debt. This model is representing one possible channel through which stock equity risk (β) can be affected by past stock returns and by which we can distinguish between Levered and Unlevered beta (β). Damodaran formula is obtained from the Fernández model by assuming beta debt equal to zero. In this paper, we will use the Damodaran (1994) model (see Equation 3) which provides a levered beta always higher than unlevered beta (**$\boldsymbol{\beta_{a,t+1}}$).** Investigating the change in levered beta and beta debt will help us to analysis indirectly the change in beta debt in terms of shock transmission. This qualitative analysis constitutes a proxy to study the beta debt. Thus, we will not have time to analyse directly the beta debt, so the Fernández will not be used in this study.

3.3 Data selection for the econometric Models

We have considered eight countries with a large sample of firms. The data have been collected from Reuter Datastream by excluding *Shari'ah* non-compliant sectors such banks, financial companies, alcohol etc. At the beginning, the sample has 3596 firms distributed over seven countries. Then, it was filtered by excluding the missing values of the parameters (such as: total Equity = "NULL", Total Assets= "NULL" or Market Capitalisation = "NULL"). MySQL software has been used in organizing and filtering the suitable data (see SQL command in the Appendix). We have retained only seven due to lack of same important variables. The table 1 below shows the breakdown of retained firms in relation to their countries. It contains the aggregated information regarding the number of firms that we found based on a large number of firms and segregated between low and high debt.

Table 2: Breakdown of Low and High debt firms in relation to their countries

Code	Country	Name	Initial Sample	Filtred Sample	NB Low Debt	NB High Debt
1	AU	AUSTRIA	132	116	28	35
2	FR	FRANCE	856	74	32	38
3	GM	GERMANY	1172	455	181	161
4	IT	ITALY	364	99	12	33
5	NL	NETHERLAND	219	98	51	47
6	PL	POLAND	637	68	0	24
7	SP	SPAIN	216	75	0	47
Total			**3596**	**985**	**304**	**385**

Then from the filtered sample, we split up it to High Debt - HD (D2TASSETS > 0.33 *called here the debt ratio threshold*) and Low Debt - LD (D2TASSETS <= 0.33) using the ratio as follows:

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

The retained period of time is equal to 5 years; by working on the quarterly basis, the majority of firms have the debt ratio swinging up and down around the threshold. For example, we have got only 24 high debt firms for Poland but zero low firms for the same period of time. This is due to missing values of the most important parameters.

In other hand, there is no problem to get a good sample for the high debt firms (D2TASSETS > 0.33). The biggest sample has 181 high debt and 161 low debt firms for Germany for the studied period of time. However, the econometric model will commingle both high and low debt portfolios and to distinguish between the two, a Dummy variable has been used for this purpose.

3.3 Data statistics for the sample

The statistics for beta per level of debt (D2TA) and per country are given below:

Table 3: Statistics for Beta, total Assets and total firms per country											
Country	Level of Debt	min	max	mean	median	mode	std	range	Total Assets	TAsset (LD+HD)	Nb Firms
1	Low Debt	-0.0001831	0.3628	0.01898	0.0005583	-0.0001831	0.08094	0.363	22767979	1555526306	60
	High Debt	0.02083	0.04703	0.03334	0.03399	0.02083	0.006914	0.0262	1532758327		
2	Low Debt	-0.002164	0.03463	0.01194	0.01025	-0.002164	0.007916	0.03679	414912997	9262604248	57
	High Debt	0.0349	0.08073	0.05958	0.06073	0.0349	0.0115	0.04583	8847691251		
3	Low Debt	0.01425	0.04906	0.02599	0.02328	0.01425	0.009175	0.03481	2199223600	47944331121	308
	High Debt	0.02809	0.06529	0.0453	0.04321	0.02809	0.009446	0.0372	45745107521		
4	Low Debt	0.000166	0.02585	0.01491	0.01401	0.000166	0.006625	0.02568	31093313	10272736949	43
	High Debt	0.01522	0.05995	0.04069	0.04318	0.01522	0.01345	0.04473	10241643636		
5	Low Debt	0.006955	0.05765	0.03279	0.03368	0.006955	0.0127	0.05069	5009339207	6874480784	82
	High Debt	0.009095	0.0757	0.031	0.02728	0.009095	0.01802	0.06661	1865141577		
6	Low Debt	0	0	0	0	0	0	0	0	231502993	24
	High Debt	0.006831	0.1187	0.02978	0.0206	0.006831	0.02672	0.1119	231502993		
7	Low Debt	0	0	0	0	0	0	0	0	18951412385	57
	High Debt	0.03152	0.04756	0.03859	0.03787	0.03152	0.004935	0.01605	18951412385		

The table above presents for each country the descriptive statistics: the means, standard deviation, median, minimum and maximum, the range for the sample. It shows also the statistics of betas, the number of firms and total assets (of each group of firms: LD and HD and the sum of both: LD+HD) considered for the beta analysis using portfolio theory. We should mention that in the case of Netherland (country number 5) the total assets for LD is higher than the total assets for HD (2.69 times more) while the opposite is happening for all the other countries in which we found that the HD size of the firms is much more higher that the LD size. In the case of Germany (country 3) the ratio is more than 20 times in favour of high debt firms (HD/LD total assets = 20.79).

However, the Total assets (expressed in US$) for all the LD portfolios countries is equal to 7.6773 E^9 , while the Total assets for the HD portfolios countries is equal to 8.7415 E^9 .The size ratio of HD to LD is equal to 11.39.

4. Results and interpretation

In this section, we start analyzing the relationship between the capital structure and the systematic risk by using the Generalized Method of moments (both GMM: difference and system). Then, we investigate the levered and unlevered betas for the seven countries considered as one portfolio and segmented two portfolios : LD and HD portfolios. We do the same analysis at the level of each country. Finally, we end our discussion by looking at the effect of the GFC on the change in betas and their lead-lag cross correlation using continuous wavelet coherence.

- ***4.1. GMM analysis***

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: (i) The category one is the case of the variables that are strictly exogenous; (ii) The category two is the case of the variables that are endogenous; (iii) The category three is the case of the variables that are predetermined but not strictly exogenous. (See table 1 in Appendix 1).

The econometric model (Equation number 1) is based on the capital structure (Debt/Equity) and since we are interested in the level of debt (Total debt to total assets), we intuitively can say that the two variables are positively correlated. So, by analysing the capital structure, we may infer the same conclusion for the level of debt.

The results are given in the table 4 below. In this estimation we have added the constant dummy variable and for the lagged capital structure variable, the interrelated dummy variable in relation to the level of debt expressed as total debt over total assets of the firm.

Table 4: Dynamic panel data estimators using GMM for Beta –Sensitivity to Market risk versus Capital Structure

	2-step Robust NC (2 2)		2-step Robust NC (6 6)		2-step Robust NC (6 7)		2-step Robust NC (7 7)	
Beta	Coef.	t	Coef.	t	Coef.	t	Coef.	t
L1.Beta	.2490981	3.93	.1449562	1.85	.2008307	2.50	.1225084	1.60
L1.Capstruct	.0002204	1.03	.0023551	2.16	.0027418	**2.54**	.0015335	2.21
inter_dmy_d2ta	-.0090494	-0.49	-.0061417	-0.62	-.0119965	-0.90	-.0134812	-1.01
dmy_d2ta	-.1284179	-4.34	-.1337203	-3.77	-.120335	-3.68	-.1563576	-4.45
forex_q	.0119623	0.663	.0159849	0.50	-.0018895	-0.07	-.0109356	-0.26
L1.ROE	.000026	1.15	.0002516	2.20	.0002922	2.60	.0001647	2.26
w(Weight)	418.3221	3.28	442.2279	2.79	384.839	**2.99**	439.9784	2.53
d2gdp_q	-.0014924	-1.75	-.001717	-1.68	-.0014279	-1.53	-.0012016	-0.99
L1.s2ta	-.0040528	-1.10	-.0969838	-1.54	-.1158213	-1.85	-.0995306	-1.41
price2bv	-.000291	-7.45	-.0006855	-4.27	-.0006549	**-3.62**	-.0003498	-1.44
MarketCap	-3.15e-06	-1.47	-3.38e-06	-1.57	-2.34e-06	-1.30	-3.48e-06	-1.50
_cons	.3529114	7.79	.4900919	5.77	.4996593	5.99	.5330787	5.31
AR(1)	z = -6.40	P> z = .000	z = -5.67	P> z = .000	z = -5.80	P> z =.000	z = -5.67	P> z = .000
AR(2)	z = 2.21	P > z = .027	z = 0.85	**P > z = .395**	z = 0.92	**P > z = .360**	P> z = 0.65	**P > z = .517**
Sargan test of overid chi2	732.4	P = .00	405.2	P = .00	561.6	P = .00	418.89	P = .00
Hansen test of overid chi2	270.4	P = .001	209.6	P = .003	268.6	P = .045	193.69	P = .004
GMM Hansen Ex. G. Chi2 [1]	183.6	P = .00	123.5	P = .000	182.5	P = .037	127.42	P = .00
GMM Diff. (H0= exo.) chi2 [2]	86.8	P = .00	86.07	P = .329	86.1	P = .329	66.27	P = .754
iv Hansen Ex. G. chi2 [3]	671.94	P = .00	203.0	P = .003	258.8	P = .066	183.98	P = .006
iv Difference (H0: Exo.) chi2 [4]	810.63	P = .901	6.57	P = .255	9.73	P = .083	9.71	P = .084
Nb Instruments|Nb Obs	216	5528	168	5528	243	5528	156	5528

- All the estimators are computed with 95% Confidence Interval [$p < 0.05$]

The table 4 provides the dynamic panel data estimators using GMM for the total volatility versus Capital Structure. The four estimations of GMM- 2 Steps robust with the sub-option “no-collapse” [with different lags: from (2 2) to (7 7)] appear to present a reasonable results. Interestingly, only the coefficient of the weight (Total assets of the firm over total assets of the sample) appears more likely to be precisely estimated in the case of lag = (6 7) with no restrictions on the instrument set for 268 over-identifying restrictions and with 243 instruments in total.

The results suggest that volatility effects exist due to both: firm level and market effects, and that the weight has stronger impact over all other; while the lagged systematic risk effect has also a quasi the same impact as the capital structure. (lagged beta and lagged capital structure are both negatively correlated with the beta). The lagged market return ROE t-1 is also negatively correlated. However, the exchange rate seems to be not statistically significant. This is quite intuitive if we consider that it is the European market is highly integrated; so the impact of exchange rate will not have much effect on the change of beta at the level of the firm within the European market.

More precisely, the systematic risk value drops by 24% from 0.49966 (value of the constant value in the third column estimation) to 0.37932 (since the dummy variable is equal to -0.12034 for firm with a ratio of debt to equity that is less than 33%). This result is obtained for both low debt (304 firms) and high debt firms (385 firms) while the firms with low level of debt have small capitalization compared to the firms with high level of debt (while the size ratio of HD portfolio is more than 11 times higher than LD). However, no difference has been found related to inter-related dummy variable which would impact the capital structure (level of debt as Debt over equity).
When we look at the sovereign debt effect, it seems not to have any statistical significant impact on the volatility which is easily to be understood in the way that a quarterly change in the sovereign debt will not affect the systematic risk of the firm in the stock market. Intuitively the lagged idiosyncratic systematic risk of a specific stock is expected to have a significant bearing on its own current value.

Turning to the lagged leverage effects, the correlation is positive for both portfolios: low debt and high debt; while the interactive dummy variable (related to the level of debt) is statistically not significant. However, the dummy variable and therefore is decreasing the value of the estimated constant in the absolute value as explained above. This result is in line with the theory only in both cases (LD and HD).

- ***4.2. Robustness analysis for the systematic risk models***

System GMM does not assume normality and it allows for heteroskedasticity in the data. Theoretically to get robust results (Roodman, 2006), we have applied the two-step estimation in order to obtain the robust Sargan test (based on the (robust) Hansen J-test), which is not available in one-step estimation. To do so, we have conducted both one-step and two-step estimations based on various tests and we presented the 4th more relevant ones (see table 4) to investigate the relationship between the capital structure and the systematic risk. We have used 689 firms and seven countries based on the 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 for AR2 test indicates that the instruments used are valid (**Yalta and Yalta, 2012**) which is the case of the tests reported in the second section of the table 3. using the "two-step robust with no collapse sub-option" for the systematic risk and using the constant dummy variable and also the "interactive dummy variable".

Overall, our statistical results are qualitatively similar for most of the experiments suggesting that the qualitative nature of the above reported findings is robust even for the less valid instruments.

- ***4.3. Levered and unlevered betas analysis***

In this section, we have computed betas for three portfolios: LD portfolio, HD portfolio and the combined portfolio between the two previous ones. In the case of all countries combined, we have computed also the unlevered beta. Furthermore, we have added the capital structure of each portfolio and the level of debt (Debt over total assets) for each 20 quarters: from quarter 2, 2008 to quarter 1 2013 in order to encompass the GFC 2008 period.

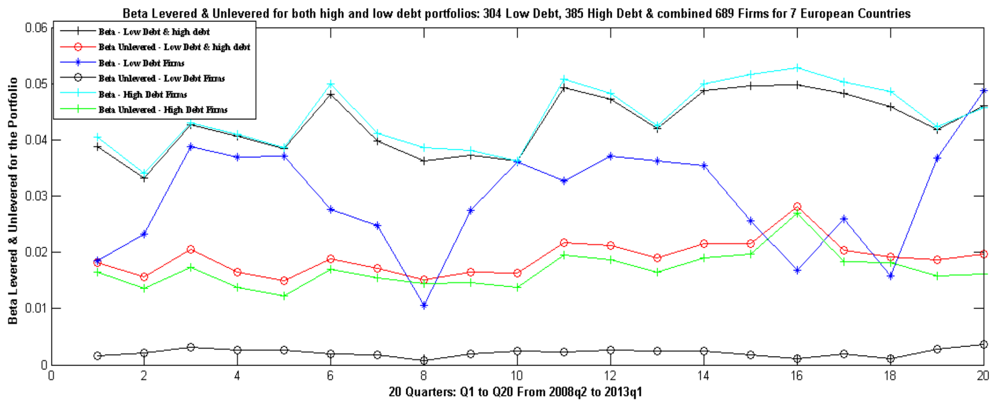

Fig 1.a: Levered and Unlevered β for high and low debt portfolio (305+385) firms from 7 European countries

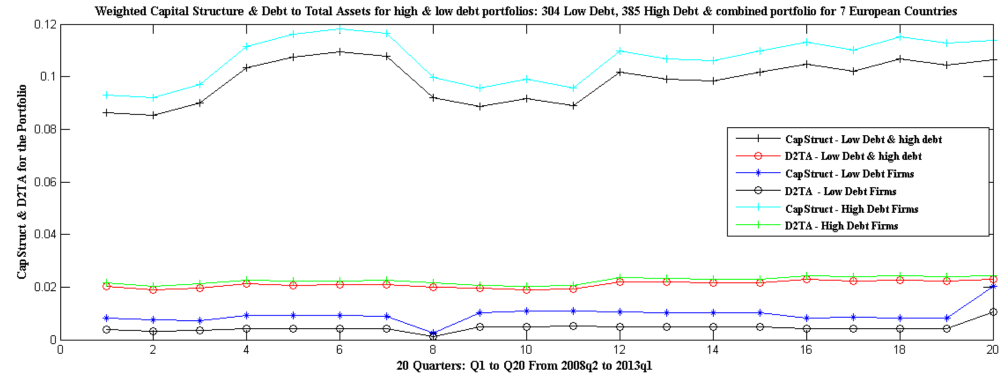

Fig 1.b: Weighted Capital Structure & D2TA for high and low debt portfolio (305+385) firms from 7 European countries

The figure 1.a shows six graphs describing the change in the levered and unlevered betas for the three portfolios while figure 1.b is showing the change in the capital structure and debt to total assets for the same portfolio and for the same period of time (20 quarters).

In Figure 1.a, we can see that the HD and the combined have the same behaviour in terms of changes during the studied period with values of the levered beta for HD are slightly higher than the levered beta for the combined portfolio. The opposite is happening for the unlevered beta, this may be explained by the fact that the impact of the financial risk due to the high level of debt is higher than the combined portfolio since the latter is containing LD debt firms taking benefit from the positive impact of the lower level of debt of those firms coming from the LD portfolio. However, we can see that unlevered beta for the LD portfolio is far away from the two previous ones. This may be due to the low level of debt within the LD portfolio while the levered beta of the LD portfolio has bigger changes but still lower than the HD portfolio and the combined one. This may be due their small capitalisation related to the HD firms.

In Figure 1.b, higher changes in the trend of capital structure for both LD and combined portfolio could be seen with higher level for LD debt than the combined portfolio. Levered Beta seems to follow this trend conducted by the capital structure. While the capital structure for the LD portfolio shows less sensitivity to the change in the capital structure and the level of debt since the equity has the main role in the capital structure of the firm.

- ***Case of the country level analysis for levered beta***

In this section, we have computed the levered beta for LD, HD and combined portfolio for each country. Our aim is to analyse the impact of the level of debt over the systematic risk. Our finding supports, in major countries, that high debt firms are riskier than low debt firms in terms of levered beta. The combined portfolios still present a quasi-level of systematic risk except in the case of Netherland. The latter requires more investigations to catch the different behaviour of LD portfolio in regard to low debt portfolio, while the combined portfolio is having a levered beta level between those of HD and LD portfolios.

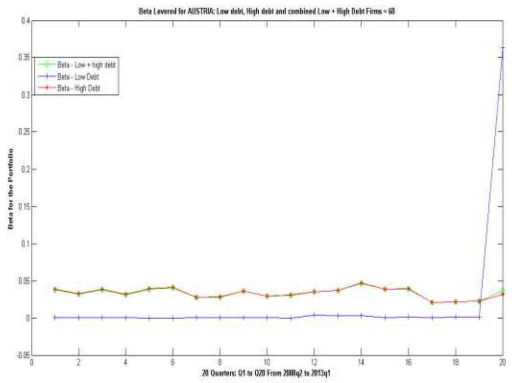

Figure 2.a: β Austria for LD,HD & combined

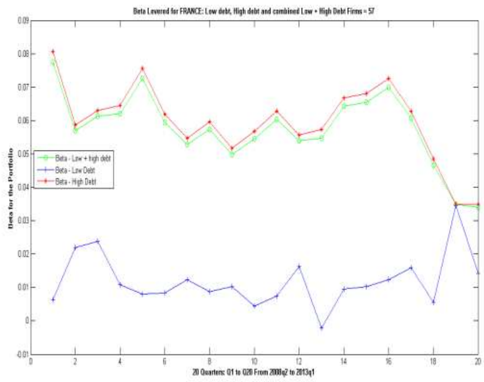

Figure 2.b: β France for LD,HD & combined

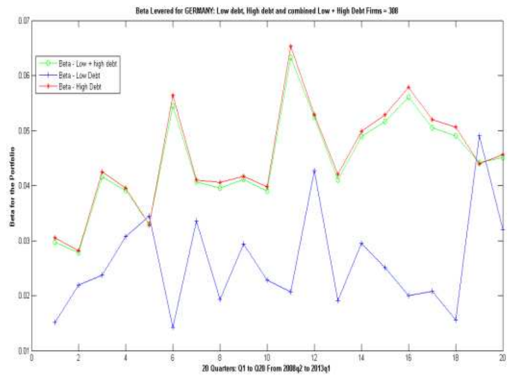

Figure 2.c: β Germany for LD,HD & combined

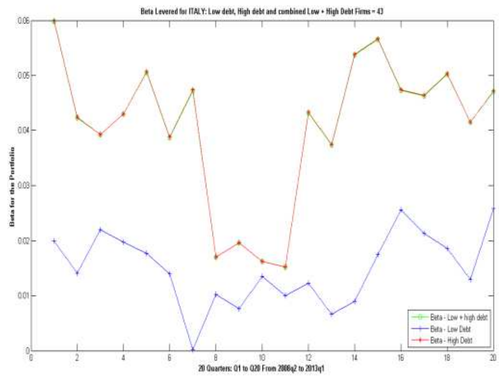

Figure 2.d: β Italy for LD,HD & combined

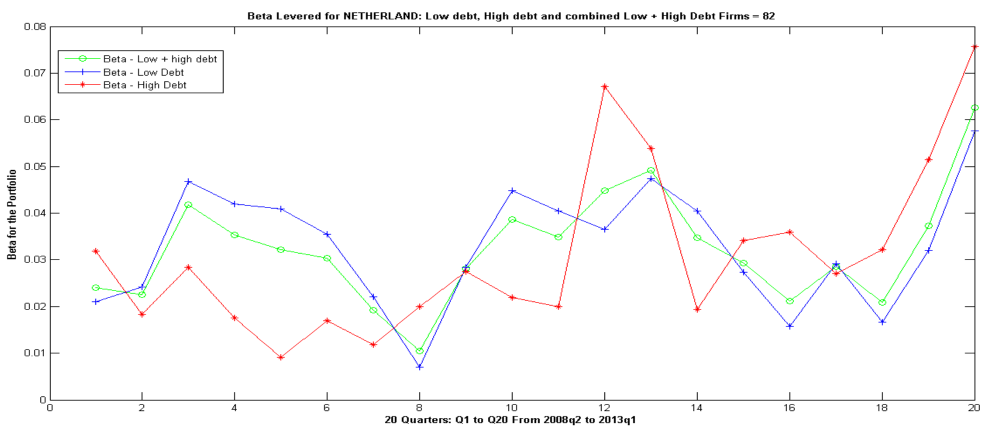

Figure 2.e: β Netherland for LD,HD & combined

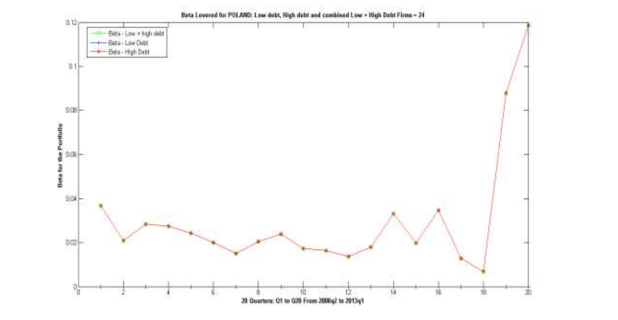

Figure 2.f: β Poland for HD only (combined = HD)

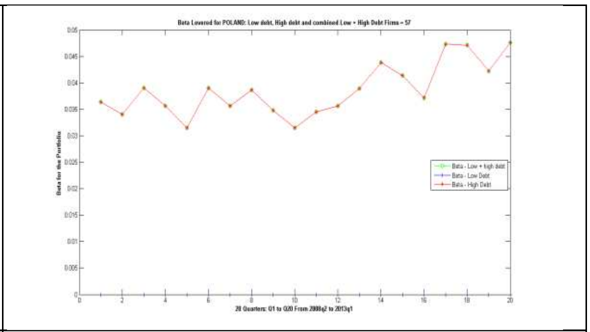

Figure 2.g: β Spain for HD only (combined = HD)

France is showing higher risk related to the HD portfolio in comparison with Germany, Italy or Poland. However, its combined portfolio is having less systematic risk compared to the HD portfolio, showing a certain benefit of diversification higher than the case of Italy or Germany.

Since we have only HD portfolio in the case of Poland and Spain, we can see from Figures 2.f and 2.g that the Spanish portfolio is showing higher systematic risk the Polish potfolio with a one exception happening in the first quarter of 2013 which we consider here as an outlier.

- ***4.4. Levered and unlevered betas analysis based continuous wavelet***

In this section, we are using the continuous wavelet transform: CWT (based on pairs between) to investigate the cross-correlation between the levered and unlevered betas in relation to the level the capital structure and the level of the debt. This will allow us, to analyse the lead-lag relationship between the studied variables. CWT, allow analyzing time series from two perspectives simultaneously - from frequency and time point of view. This will allow us to capture localized intermittent periodicities. We are using below the wavelet coherence as our aim is to extract time-frequency features and in particular the lead-lag relationship between betas and other variables.

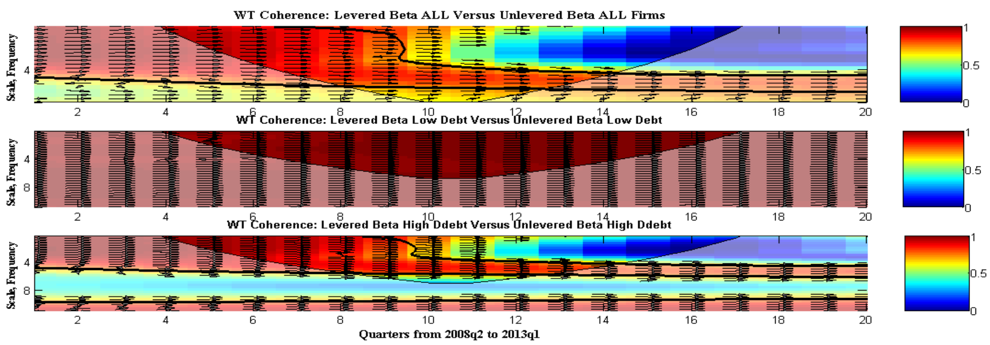

Figure 3.a WTC: Levered β versus Unlevered β for Low, High debt and combined portfolios

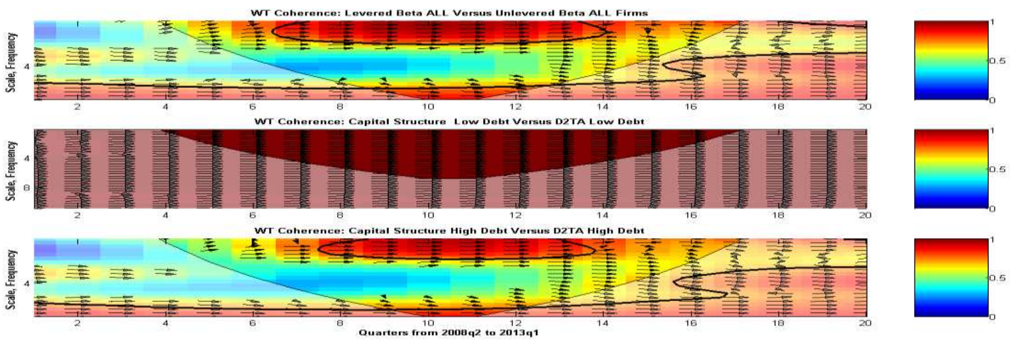

Figure 3.b WTC: Levered β versus Unlevered β for Low, High debt and combined portfolios

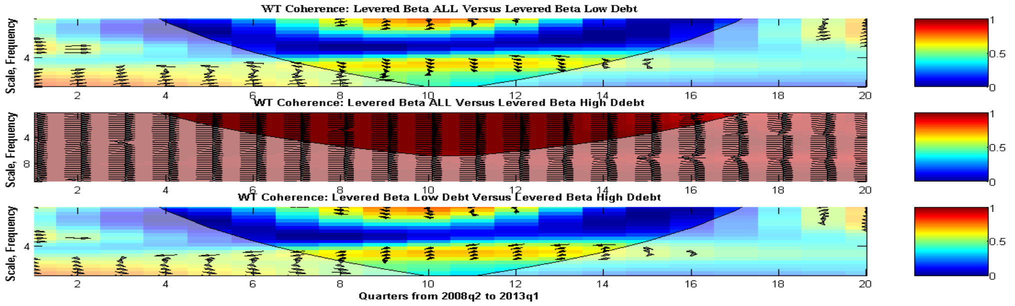

Figure 3.c WTC: Levered Combined β vs LD & HD then, Levered β Low vs High debt

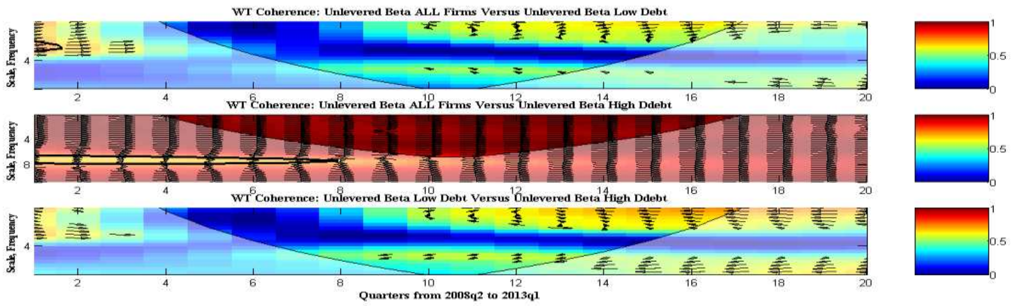

Figure 3.d WTC: Unlevered β vs Unlevered β for LD & combined portfolios and Low, High debt

In the graphs presented in Figure 3 (7 graphs from 3.a to 3.h), the 5% significance level against red noise is shown as a thick contour (displayed as a black parabolic line). The relative phase relationship is shown as pointing arrows (- Right: in-phase; - Left: anti-phase).

The co-movement is expressed through high coherency (red areas) showing strong local correlation and low coherency (blue areas) will indicate low correlation. So, the cross-wavelet coherency is able to determine varying characteristics of the relationship between the levered and unlevered betas and the other parameters in the time–frequency domain. This will allow us to look at the short-term and long-term shocks related to contagion.

Looking at Figure 3, intuitively we can draw some important results. Our coherency plots generally display one large area of high-coherency starting from the first quarter of 2009 (quarter 4) until the third quarter of 2011 (quarter number 14) encompassing the year 2010 related to the Eurozone crisis. The year 2010 can be linked to the second stage of the GFC, which is followed by the major global instability. Specifically a shock transmission channel with simultaneous increase can be observed through co-movement mainly at higher frequency-bands (below 12 months) between levered and unlevered betas and also between levered beta and capital structure as well. We can see that, in terms of unlevered beta, the LD portfolio has generally a complete different behavior compared to the HD and combined portfolio. Over whole, a change in the trend can be noticed in the cross-correlation between levered and unlevered beta (figure 3.a) showing the evidence of short term shock transmission with a structural break starting from the second quarter of 2010 (just after the quarter number 9). This may be due to the Eurozone crisis. The contagion effect due to the leverage seems to be related to short-run market linkages than to fundamental-based linkages.

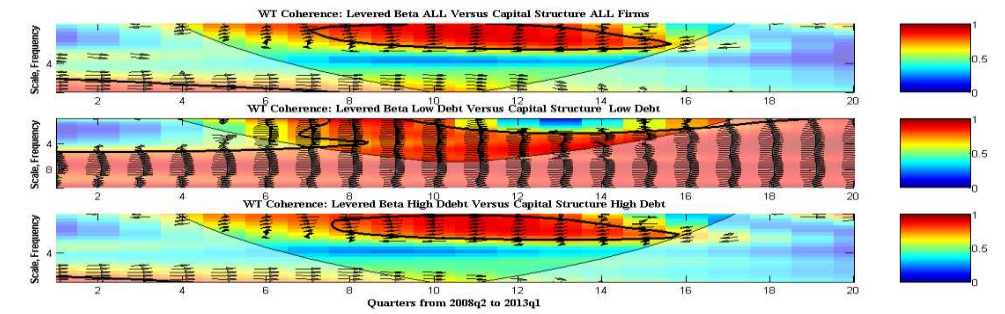

Figure 3.e WTC: Levered β vs CapStrut. for Combined, LD & HD debt portfolios

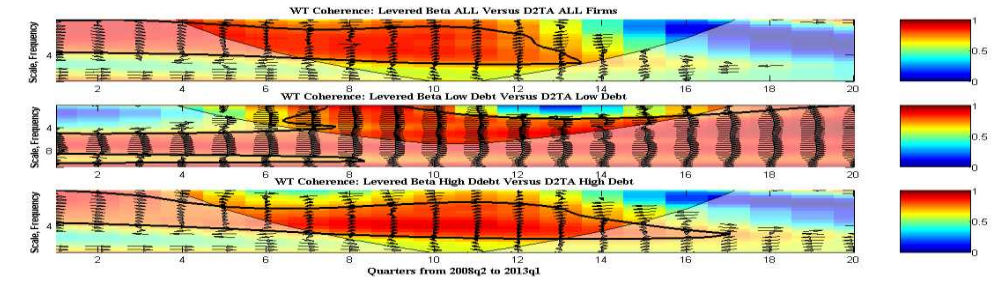

Figure 3.f WTC: Levered β vs Level of debt (D2TA) for Combined, LD & HD debt portfolios

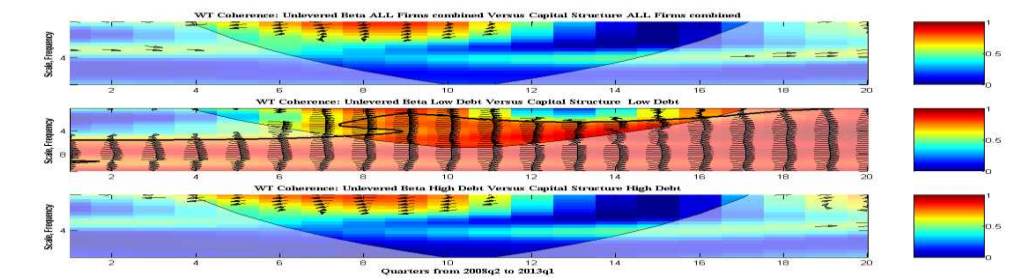

Figure 3.g WTC: Unlevered β vs CapStruct. for Combined, LD & HD debt portfolios

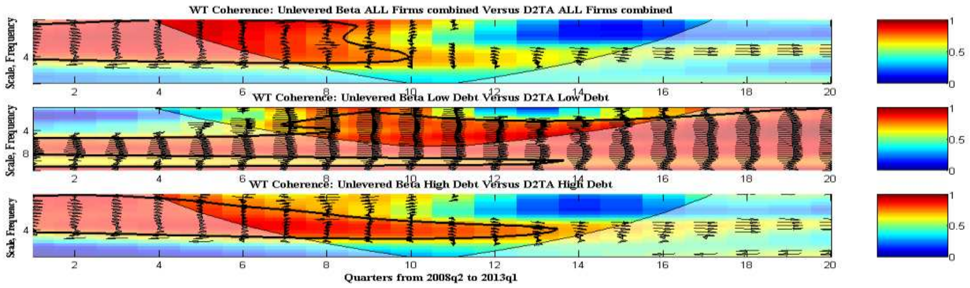

Figure 3.h WTC: Unlevered β vs Level of debt (D2TA) for Combined, LD & HD debt portfolios

5. Conclusion and implications

In this paper, the quarterly times series data of seven European countries have been examined to assess a firm's risk exposure within the capital structure theory. We find that the leverage effect is significantly and positively associated with systematic risk and that leverage augments systematic risk. Our findings have implications on the stability regarding the *Shari'ah* stock screening. We adopt a panel GMM framework which allows us to control simultaneously for country effect and firm characteristics effects taking into account the heterogeneity across firms. Moreover, wavelet coherence has shown that the level of debt has a substantial role in the short term shock transmission at the level of levered and unlevered betas. The systematic risk analysis across countries has shown that, in general, the low debt portfolios haves less systematic risk than both high debt and combined portfolios with the same countries.

Our finding shows a significant positive correlation of the debt with the sensitivity to market risk. Interestingly, we found that the systematic risk behaves differently regarding the level of the debt (Debt over total Assets) which is the ratio used in *Shari'ah* stock screening. Its value drops by 24% from 0.49966 (for the Constant value) to 0.37932 (since the dummy variable is equal to -0.12034 for firm with a ratio of debt to equity is less than 33%) for the whole panel combining firms with low and high level of debt and having small and big capitalization.

The firm's size (represented as the weight of the firm within the portfolio), the lagged ROE and also the "Price to the book value" are both statistically significant and negatively correlated with the systematic risk. This is consistent with the theory.

However, the sovereign debt and the exchange rate have no impact on the systematic risk, while a change of 1% of lagged value of beta will induce a change of 0.2% in the value of beta.

Overall, our findings are consistent with the theory within the capital structure of the firm, in which the level of debt based Shari'ah screening plays an important role in the stability of the systematic risk.

Our approach based on the ratio of the first criteria of Shari'ah stock screening can be extended to the other ratios of the stock Shari'ah screening of stock market listed firms for all the studied countries, while the GMM analysis could be extended to more heterogeneous countries rather than focusing solely on seven European countries. It would also be of interest to examine the other beta parameter such as total volatility and Sharpe ratio in relation to the Shari'ah screening criteria within the same approach and by adding other macro-economic variables at the level of the country.

Policy implications in term of Investment

On a practical matter, evidence about how systematic risk is affected by the leverage of the firm is relevant to managers, investors and regulators as well. From our findings, two potential policy implications could be suggested below:

1. At the regulator level, the regulator may have to issue standards about reducing the debt level in the listed companies in regard to its detrimental negative impact on the business viability.
2. At the investor level, debt has a tax benefit to the firm while the firm's risk is borne only by the stockholders (Hamada, 1992). Higher leverage increases the systematic risk and decrease the stability in the market. This makes equity investment in the firm riskier. Investors may not fully participate in any new recapitalization of a listed firm if the latter would not be able to reduce its leverage. This may open a new way to the partnership based Musharakah to take place within the compliant firms in the stock market.

- Investors may have to consider their investment strategy to invest in Shari'ah companies since these firms are not heavily involved in high leverage and hence the systematic risk of these firms provides less instability. This may also be attractive for the non-Muslim investors.

Appendix 1

Table 1: Exogenous and endogenous variable

Variable Id	Name and category of the variable	Status
1	Beta as systematic risk	Exogenous
2	Capital Structure (Debt/Equity)	Exogenous
3	Local Currency over the US Dollar	Strictly exogenous
4	ROE Rate of Return	Predetermined but not strictly exogenous
5	Size as the weight of the firm within the sample based total assets	Predetermined but not strictly exogenous
6	Sovereign Debt/GDP,	Strictly exogenous
7	Sales over Total Assets	Predetermined but not strictly exogenous
8	Price to Book Value	Predetermined but not strictly exogenous
9	Market Capitalisation	Predetermined but not strictly exogenous

Appendix 2

List and Status of all sectors

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

Appendix 3

```
-- LOW DEBT GROUP case of GERMANY (GM)
create view v_2005_LD_GM_ as
select p1.country,
      p1.Q,
      p1.company_code,
      p1.BETA_Q,
      (p1.WC03251 + p1.WC03051)/p1.DWSE as CapStruct,
      (p1.WC03251 + p1.WC03051)/p1.DWTA as D2TA,
      p1.FOREX_Q,
      p1.D2GDP_Q,
      p1.DWSL/p1.DWTA as S2TA,
      p1.mvc as MktCap,
      p1.DWRE as ROE,
      p1.DWTA,
      (WC01451/WC01401) as T
     PTBV
from pivoted p1
where not exists
      (select null from pivoted p2
      where (
            ((p2.WC03251 + p2.WC03051)/p2.DWSE) > 0.33
            and ((p2.WC03251 + p2.WC03051)/p2.DWTA) > 0.33
```

```
-- HIG DEBT GROUP  case of GERMANY (GM)
create view v_2005_HD_GM as
select p1.country,
      p1.Q,
      p1.company_code,
      p1.BETA_Q,
      (p1.WC03251 + p1.WC03051)/p1.DWSE as CapStruct,
      (p1.WC03251 + p1.WC03051)/p1.DWTA as D2TA,
      p1.FOREX_Q,
      p1.D2GDP_Q,
      p1.DWSL/p1.DWTA as S2TA,
      p1.mvc as MktCap,
      p1.DWRE as ROE,
      p1.DWTA,
      (WC01451/WC01401) as T,
      PTBV
from pivoted p1
where not exists
      (select null from pivoted p2
      where ( ((p2.WC03251 + p2.WC03051)/p2.DWSE) <= 0.33
            and ((p2.WC03251 + p2.WC03051)/p2.DWTA) <= 0.33
            or p2.WC03251 is null
```

```
            or p2.WC03251 is null
            or p2.WC03051 is null
            or p2.DWSE is  null
            or p2.DWSE = 0
            or p2.mvc is null
            )
      and    p2.company_code = p1.company_code
      and    p2.country = p1.country
      and    p2.country = 'GM'
      and    Q >= '2008q2'
      -- and Q >= '2005q1'
      and    Q <= '2013q1'
      )
and  p1.country = 'GM'
and ((p1.WC03251 + p1.WC03051)/p1.DWSE) <= 0.33
and ((p1.WC03251 + p1.WC03051)/p1.DWTA) <= 0.33
and    Q >= '2008q2'
and    Q <= '2013q1'
and p1.MVC <>  'NULL'
and p1.RETURN_Q <>  'NULL'
and p1.DWSE <> 0
and p1.BETA_Q <> 0;
```

```
            or p2.WC03051 is null
            or p2.DWSE is  null
            or p2.DWSE = 0
            or p2.mvc is null
            )
      and    p2.company_code = p1.company_code
      and    p2.country = p1.country
      and    p2.country = 'GM'
      and    Q >= '2008q2'
      -- and Q >= '2005q1'
      and    Q <= '2013q1'
      )
and  p1.country = 'GM'
and ((p1.WC03251 + p1.WC03051)/p1.DWSE) > 0.33
and ((p1.WC03251 + p1.WC03051)/p1.DWTA) > 0.33
and    Q >= '2008q2'
-- and Q >= '2005q1'
and    Q <= '2013q1'
and p1.RETURN_Q <>  'NULL'
and p1.BETA_Q <> 0
and p1.DWSE <> 0;
```

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