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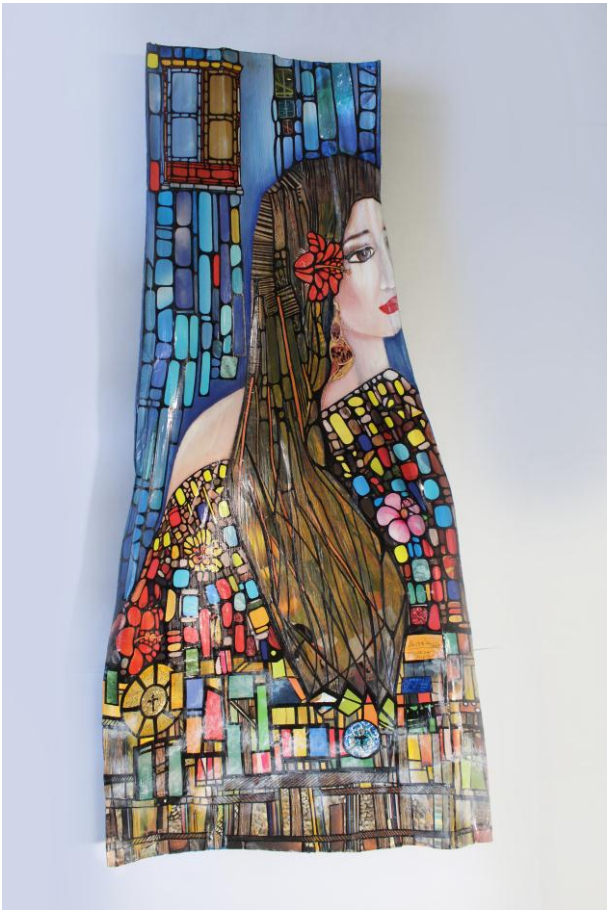

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Capital structure determinants of Shariah and Non-Shariah companies at Bursa Malaysia

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Abstract

This paper attempts to investigate the effect of total assets, fixed assets, current assets, sales, return on equity and earning per share on the capital structure of Shariah and Non-Shariah listed companies at Bursa. The methodology is based upon static panel data analysis, namely Fixed Effect and Random Effect Models. The empirical results show that assets and sales are important in explaining firm's capital structure in Shariah companies. In conclusion, any increase in the level of firm's current asset is likely to be supported by short-term borrowings. As such, working capital management seems credible in explaining firm's choice of financing.

Keywords: Capital Structure Theories, Shariah Companies.

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Determinantes de la estructura de capital de las compañías Shariah y No Shariah en Bursa Malasia

Resumen

Este documento intenta investigar el efecto de los activos totales, activos fijos, activos corrientes, ventas, rendimiento de capital y ganancias por acción en la estructura de capital de las compañías que cotizan en la Sharia y en las no Sharia en Bursa. La metodología se basa en el análisis de datos de panel estático, a saber, Modelos de efectos fijos y de efectos aleatorios. Los resultados empíricos muestran que los activos y las ventas son importantes para explicar la estructura de capital de la empresa en las compañías Shariah. En conclusión, es probable que cualquier aumento en el nivel del activo actual de la empresa sea respaldado por préstamos a corto plazo. Como tal, la administración del capital de trabajo parece creíble al explicar la elección de financiamiento de la empresa.

Palabras clave: Teorías de la estructura de capital, Compañias Shariah.

1. INTRODUCTION

From the mid of last century, the research work on the topic of capital structure has dramatically increased and it has become a major and most debated topic of discussion in the corporate finance world. In term of finance, Capital Structure is defined as a combination of debts, equities and hybrid securities which is used by a firm for investing its operations and assets to grow and achieve its strategic objectives.

Therefore, financial managers are required to design an optimal capital structure from various sources of finance with the best mix of debt, equity and internal and external financial resources (Mazhar et al., 2010). An optimal capital structure helps firms to achieve its long-term aim of financial growth and reduces the weighted average cost of capital. However, in order to design the best optimal capital structure for a firm, the factors which help to make a best optimal mix of debt and equity must be taken into consideration by financial managers (Shawtari et al., 2016). Although many empirical investigations were done to analyze factors of capital structure, their results are ambiguous and there have been limited studies focused on the shariah based companies.

Currently, in most Islamic countries, Islamic finance is impossible to overlook because of its enormous size. As a result, the Shariah-based financial model is one of the rapidly developing sectors in a worldwide financial market. In comparison with each other, conventional finance is mainly a debt-based market and agrees on a risk transfer, while on the other hand, Islamic finance is asset-based and mainly focuses on risk sharing. Islamic finance focuses on equity-based financing in comparison of debt financing. Similarly, Islamic finance encourages distribution of loss and profit between the partners and firms which are obeying Islamic financing. The divergence of culture and religion in Malaysian society has resulted in the formation of two types of financial systems i.e. the conventional financial system and Shariah-based (Islamic) financial system. Due to this dual financial system, Malaysia is among the top Islamic financial

champion. However, Shariah dependent firms are strictly required to follow all those standards which are fixed by SAC in accordance with Shariah-based principles (Haseeb, 2018).

The Shariah Advisory Council (SAC) is a reference body and an advisor to Bank Negara Malaysia and it also has a responsibility to confirm and make sure that all takaful and Islamic banking offers are according to Shariah-based principles (Hussain et al., 2018). The screening methods of SAC to ensure that shariah approved firms' stocks are according to the rules and principles of Islam is very critical. The SAC confirms and checks those fundamentals which are according to Islamic teachings and are in accordance with Islamic principles (Adam and Bakar, 2014). Organizations generally require funds for routine operations and banks are the main source of credit in any financial system (Kumar and Kaushal, 2017). However, in case of Shariah-based firms, taking debt from a bank and other financial institutions to meet its capital requirements is a tricky solution because of interest (Riba) factor which is strictly prohibited in Islam. Similarly, for Shariah-based firms, SAC imposes a very strict restriction to maintain its debt equity ratio which is less than 33 percent. Although various studies have investigated factors that may affect the capital structure of firms, in the context of Malaysia, only a few studies have focused on Shariah-based firms. Therefore, an investigation is required to explore and test the driving forces and their association with the capital structure of Malaysian listed firms. This paper seeks to fill this void by exploring the determinants of capital structure within Malaysian Shariah based firms and by analyzing all sectors of Bursa

Malaysian main market. The individuality of this empirical investigation is that it is done by covering larger sample set of 441 listed shariah based firms, which is biggest sample set ever used for analyzing and exploring the capital structure determinants of listed Malaysian Shariah based firms.

2. LITERATURE REVIEW

On the basis of the conventional theories of capital structure, the modern studies on the capital structure were initiated by (Modigliani and Miller, 1958). Principally, MM Theory consists of three propositions. In proposition I, they developed the capital structure irrelevance proposition which hypothesized that under a perfect capital market, a firm decision related to the capital structure is independent of its market value and related cost of capital. Essentially, a perfect capital market exists when there is no existence of transaction cost, agency and bankruptcy cost, taxes and symmetry of information. Likewise, as per proposition II, the firm's leverage has no effect on the weighted average cost of capital (WACC). Proposition III stated that the firm's value is not affected by the dividend policy of the firm. (Abduljamal et al., 2013). In addition, another capital structure theory which is more similar to MM Theory is Trade-off Theory. This theory suggests the idea that firms can choose their capital structure by balancing the benefits of borrowing, especially tax savings and with the costs which are related to borrowing counting bankruptcy costs (Abdeljawad et al., 2013). In comparison, Trade-off Theory basically

sets as a competitor to Pecking Order Theory and attention on the idea of the cost of financial distress and agency cost. However, Pecking Order Theory gives first preferences to internal financing, then debt and then in the ending equity. Pecking Order Theory believes that financing cost would increase with the asymmetric information and does not focus on optimal capital structure (Abdeldayem and Sedeek, 2018).

Pandey (2001) investigates the determinants of capital structure of Malaysian firms by providing new visions by relating capital structure with market power and profitability. Ozkan (2001) highlights the observed target determinants of a firm's capital structure and the process of adjustment to achieve the selected target. Deesomsak et al. (2004) study the determinants of capital structure in Asia Pacific countries and found that capital structure of countries is dependent on the environment in which firms are operating. Hussain et al., (2018) similarly utilize a sample of firms from Asia Pacific countries and provide evidence that equity prices play a similar role. Gill et al. (2009) analyze the determinants of capital formation for the service industry of the U.S and check the impact of income tax, size, profit and growth on return on equity (ROA) in which their finding showed that leverage is an indirect relation to firm's performance.

Saad (2010) explores the best practices of a firm's capital structure in Malaysia and found a substantial relationship to the firm's capital structure. Zabri (2012) investigates capital structure determinants of Malaysian small and medium size enterprises (SMEs).

The result of this investigation reveals that small medium enterprises and large firms' capital structure determinants are nearly similar. Mohammadzadeha et al. (2013) follows Static Trade-off Theory and Pecking Order Theory and finds the negative association between capital structure and profitability. A study by Saarani and Shahadan (2013) aims to analyze the capital structure determinants of small, medium and large firms of Malaysia by discussing Trade-off Theory and Pecking Order Theory. A study by Yusuf et al. (2013) explains the capital structure determinants of Malaysian electronic and electronic sector. By using debt ratio as a variable for capital structure, results are found on average. Hussain and Miras study capital structure determinants of listed firms of Malaysian food producer sector. The total debt ratio is taken as dependent variables and size, growth, liquidity and asset tangibility are taken as independent variables to investigate the capital structure determinants of firms. Mursalim et al. (2017) study capital structure determinants of Thailand, Indonesia and Malaysia and found company size, profitability and volatility have main and steady roles in defining the variation of firm's capital structure. Their results showed that capital structure of a firm is significantly associated with the firm's performance.

3. DATA AND METHODOLOGY

This study involves a total of 558 companies across all sectors of (except for financial sector) Bursa Malaysia main board over twelve year's period from 2005 to 2016. The secondary data are extracted

from Bloomberg database and are divided into Shariah and Non-Shariah portfolios. The Shariah portfolio consists of 441 companies, while the Non-Shariah portfolio is made up of 117 companies. Technically, the research model is estimated using Static Panel Data Analysis (PDA) and expressed as follows:

$$DE_{it}= \alpha+\beta1TA_{it}+\beta2FA_{it}+\beta3CA_{it}+\beta4Size_{it}+\beta5ROE_{it}+\beta6EPS_{it}+\mu it \quad (1)$$

where α and β are coefficients, i and t are individual and time specific effects, μit is the error term, DE is the dependent variables followed by the independent variables. TA is total assets, FA is total fixed assets, CA is a current asset, Size is represented by sales, ROE is a return on equity and lastly EPS denotes Earnings Per Share. This empirical model provides the framework for detailed analysis on explaining the theoretical relationships between the independent and dependent variables. The most common methodology involves the deployment of two static panel data analysis, namely the fixed effects model and the random effects model. In selecting the credible model between these two, one must be clear with the objective of the research and problems associated with the exogeneity of the explanatory variables.

The error term plays a very significant role in PDA. Under the fixed effect model assumptions, this error term is assumed to vary non-stochastically over 'i' or 't' making the fixed effects model similar to a dummy variable model. As such, this model assumes that there are unique attributes of individuals that do not vary across time. Note that

it is the assumptions about the error term that dictates as to whether this study is tailored towards fixed effects or random effects. Also, it is worthy to note that the random effects model is, in fact, a special case of a fixed effect model. Unlike the fixed effect model, the random effects analysis assumes its error term to vary stochastically over 'i' or 't' demanding some adjustments on the error variance components. In deciding the more efficient model between fixed and random effect approaches, the deployment of Breusch & Pagan (1979) and F test for the joint significance of individual fixed effects are warranted.

4. FINDINGS

The balanced panel data are extracted into Bloomberg and analyzed in SAS programs. To begin with, the descriptive statistics of both Shariah and Non-Shariah companies over the twelve year's period are presented in Table 1 and Table 2 below.

Table 1: Descriptive Statistics of 441 Shariah-Compliance Companies

Variable	Maximum	Minimum	Mean	Median	Mode	Std Dev
DE	37.8510597	0	0.8507328	0.6219067	0	0.9747065
TASSET	132902.2	3.785	1453.81	297.6352	529.45699	6134.74
FASSET	101685.4	0	669.884652	97.0565	129.07606	3923.73
CA	81459.81	2.839	520.4985226	142.001	9.8533	2030.51
SALES	47254.5	0	776.5678828	202.2575	385.0238143	2790.28
ROE	148.3993	-2.590124	0.1148609	0.0681391	0.1622616	2.5833543
EPS	39.2733	-9.424	0.1170093	0.05445	0.02	0.7385089

Table 1 shows that the mean DE is 0.85, while the median DE stands at 0.62. The maximum TASSET is recorded at approximately RM133 million, but the mean TASSET settles at a much lower value of RM1.453 million. The mean CA and SALES are registered at RM520,000 and RM776,000 respectively. The mean ROE is seen at a much lower percentage of 0.114%, followed by the mean EPS of just 0.117 cents. From the standard deviation analysis, there has been a huge degree of dispersions among all the 7 variables.

Table 2: Descriptive Statistics of 117 Non-Shariah Companies

Variable	Maximum	Minimum	Mean	Median	Mode	Std Dev
DE	23.86523	0.001978	1.026347	0.577431	0.050461	1.489544
TASSET	92545.8	11.9658	2303.75	405.192	139.8575	7925.6
FASSET	42830.4	0.003	947.6765	104.3012	0.003	3741.93
CA	32416	2.7954	844.5031	189.083	1336.72	2772.55
SALES	20049.17	0	1001.36	192.7025	10.28644	2547.8
ROE	40.1296	-9.28229	0.095772	0.067119	0.036276	1.147652
EPS	72.387	-3.96	0.189458	0.05175	0.0041	2.041229

In the case of Non-Shariah companies, their mean DE stands at 1.02 which is slightly higher than its counterpart. Interestingly, the median of DE is slightly lower at 0.577 as compared to Shariah companies. Looking at the DE distribution, its standard deviation of 1.489 seems much higher than the Shariah companies. In terms of tangibility, the mean TASSET, FASSET and CA are found to be much higher than the Shariah counters. With respect to profitability, the

Non-Shariah portfolio reports mixed results. The mean ROE is slightly lower at 0.095%, but the mean EPS settles at higher level of almost 0.19 cent. Similar to the Shariah portfolio, the degree of dispersion from the mean line among all the 7 variables are found to be relatively high.

Table 3: Breush Pagan Test on Shariah and Non-Shariah Companies

Breusch Pagan Lagrange Multiplier Test (Two Way) H_0: Accept Pooled OLS H_1: Accept Random Effect				
DF	Shariah m Value	Shariah Pr > m	Non-Shariah m Value	Non Shariah Pr > m
2	9333	<.0001*	2360	<.0001*

*significant at 5%

Table 3 reports the result of Breusch Pagan test and this test is performed to examine the presence of heteroscedasticity in a panel data model. Obviously, the p-values suggest that acceptance of alternative hypothesis for both shariah and non-shariah companies. It is now evident that the random effect is more efficient than the pooled OLS. Moving ahead, the two models are estimated using Wallace and Hussain Variance Components methodology and their results are shown in Table 4 below.

Table 4: Wallace and Hussain Random Two Effects on Shariah and Non-Shariah Companies

The PANEL Procedure Wallace and Hussain Variance Components (RanTwo) Dependent Variable: DEBT EQUITY		
Model Description:		
Category:	Shariah	Non-Shariah
Estimation Method	RanTwo	RanTwo
Number of Cross Sections	441	117
Time Series Length	12	12
Fit Statistics:		
	Shariah	Non-Shariah
SSE	5182.9161	1398.50
MSE	0.9814	1.004
R-Square	0.426	0.007
Variance Component Estimates		
	Shariah	Non-Shariah
Variance Component for Cross Sections	0.413243	1.246223
Variance Component for Time Series	0.004236	0.000605
Variance Component for Error	0.308479	0.953807

Table 4 summarizes the test statistics from Walace and Hussain estimation method and it is quite a surprise to see low R^2 of 0.007 on the Non-Shariah model. On the contrary, the coefficient of determination on Shariah model stands a higher value of 0.426 implying a better model fitting for these Islamic stocks. At this preliminary level, the model specifications seem fit on the shariah

stocks as compared to its counterpart. Technically, the low R^2 may not warrant a desirable goodness of fit for this estimated model. However, this statistical limitation is not an alarming issue for static panel data modeling, particularly in the case of cross-section dominant like Non-Shariah companies. Generally, the R^2 is expected to take a lower value when the panel data is more cross-section dominant.

Table 5: Hausman Test for Random Effect on Shariah Companies

Hausman Test for Random Effects H0: Random Effect Exists H1: Presence of Fixed Effect		
F	m Value	Pr > m
	57.03	<.0001*

*significant at 5%

The results of the Hausman test on the Shariah companies are depicted in Table 5 and its p-value clearly shows the acceptance of alternative hypothesis that supports the presence of fixed effect in the model.

Table 6: Hausman Test for Random Effects on Non-Shariah Companies

Hausman Test for Random Effects H0: Random Effect Exists H1: Presence of Fixed Effect		
DF	m Value	Pr > m
6	5.44	0.4892

*significant at 5%

In the case of Non-Shariah companies, the p-value from the Hausman test in Table 6 indicates that the null hypothesis cannot be rejected and therefore suggesting the presence of random effect in the Non-Shariah model.

Table 7: Parameter Estimates from Fixed Effect and Random Effects Models

Parameter Estimates									
Model Category:		Shariah Companies (F-Test Model: Two-Way Fixed Effect)				Non-Shariah Companies (Wallace-Hussain: Two-Way Random Effect)			
Variable	DF	Estimate	Standard Error	t Value	Pr > |t|	Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.426386	0.159300	2.68	0.0075	0.996486	0.1094	9.11	<.0001
TASSET	1	-0.00004	0.000012	-3.02	0.0025*	0.00003	0.000034	0.87	0.3818
FASSET	1	-0.00005	0.000016	-3.16	0.0016*	3.54E-06	0.000047	0.07	0.9404
CA	1	0.000468	0.000017	27.74	<.0001*	-0.00011	0.00007	-1.55	0.1215
SALES	1	-0.0001	0.000012	-8.14	<.0001*	0.000055	0.000036	1.54	0.1230
ROE	1	-0.0013	0.003070	-0.42	0.6735	-0.05008	0.0244	-2.05	0.0406*
EPS	1	-0.03916	0.011300	-3.48	0.0005*	-0.00887	0.0137	-0.65	0.5167

*significant at 5%

Debt Equity ratio is taken as a dependent variable, representing the firm's capital structure. Table 7 reports the parameter estimates of the two competing models. There are five key variables that explain variations in the Shariah companies' capital structure legitimately: total assets, fixed assets, current asset, sales and earnings per share. Interestingly, this study also finds that only ROE is relevant in explaining the firm's capital structure among the Non-Shariah companies. These aspects of tangibility and profitability are well

explained by Pecking Order and Modigliani-Miller theories and they seem fit in explaining the phenomenon of the capital structure of listed companies at Bursa Malaysia, particularly the Shariah portfolio.

5. CONCLUSION

The study has discovered new evidence on the key determinants of firm's capital structure across Shariah and Non-Shariah companies at Bursa Malaysia. With regard to Shariah companies, the TASSET, FASSET, CA, SALES and EPS are found to be statistically significant in relation to DE. All these independent variables (except for CA) are negatively related with the DE. With respect to Non-Shariah companies, only ROE is significantly related to the DE and they are also negatively correlated. A positive significant relationship between CA and DE signals firm's credibility in managing its liquidity. Any increase in the level of a firm's current asset is likely to be supported by short-term borrowings. As such, working capital management seems credible in explaining a firm's choice of financing. An efficient liquidity management not only helps ensure a firm's ability to meet short-term cash flow obligations, but also creates a trade-off between the cost of debt and the benefit of debt. As explained by the Trade-off Theory, so long as the benefit of debts outweighs the cost of debts, the firm is expected to move towards its optimal point of capital structure. It is hoped that the top management of a company would understand the important interactions between a firm's capital structure and its specific factors, particularly earnings potential and liquidity

management. No doubt that every manager works to maximize the firm's value via maximizing firm's share price, but ultimately management must also strike the balance between the firm's financial soundness and its long-run sustainability.

REFERENCES

ABDELDAYEM, M., & SEDEEK, D. 2018. **Managerial Behavior and Capital Structure Decisions; Do Overconfidence, Optimism and Risk Aversion Matter**? Asian Economic and Financial Review, Vol. 8, N° 7: 925-945. USA.

ABDELJAWAD, I., NOR, F., IBRAHIM, I., & ABDUL, R. 2013. **Dynamic Capital Structure Trade-off Theory: Evidence from Malaysia. Proceedings of 3rd Global Accounting**, Finance and Economics Conference, Vol. 5-7, N° 9(6): 1–10. Germany.

ABDULJAMAL, A., GEETHA, C., MOHIDIN, R., ABDULKARIM, M., SANG, L., & CH'G, Y. 2013. **Capital Structure Decisions: Evidence from Large Capitalized Companies in Malaysia.** Interdisciplinary Journal of Contemporary Research in Business, Vol. 5, N° 5: 30–49. UK.

ADAM, N., & BAKAR, N. 2014. **Shariah Screening Process in Malaysia**. Procedia - Social and Behavioral Sciences, 121(September 2012), pp. 113–123. Netherlands.

BREUSCH, T., & PAGAN, A. 1979. **A simple test for heteroscedasticity and random coefficient variation**. Econometrica, Vol. 47, N° 5: 1287–1294. USA.

DEESOMSAK, R., PAUDYAL, K., & PESCETTO, G. 2004. **The determinants of capital structure: Evidence from the Asia Pacific region**. Journal of Multinational Financial Management, Vol. 14, N° 4–5: 387–405. Netherlands.

GILL, A., BIGER, N., PAI, C., & BHUTANI, S. 2009. **The Determinants of Capital Structure in the Service Industry: Evidence from United States**. The Open Business Journal, Vol. 2, N° 1: 48–53. UAE.

HASEEB, M. 2018. **Emerging Issues in Islamic Banking & Finance: Challenges and Solutions**. Academy of Accounting and Financial Studies Journal, 22, 1-5.USA

HUSSAIN, H., HADI, A., MOHAMED-ISA, A., SALEM, M., KAMARUDIN, F., & JABARULLAH, N. 2018. **Adjustment to Target Debt Maturity and Equity Mispricing: Evidence from Asia Pacific**, Polish Journal of Management Studies, Vol. 17, N^{o} 2: 87-100. Poland.

KUMAR, A., & KAUSHAL, S. 2017. **The Effect of Capital Structure on Profitability: Evidence from Indian Energy Sector Companies**. Indian Institute of Technology Delhi, pp. 653–659. India.

MAZHAR, A., & NASR, M. 2010. **Determinants of Capital Structure Decisions: Case of Pakistani Government Owned and Private Firms.** International Review of Business Research Papers, Vol. 6, N^{o} 1: 40–46. USA.

MODIGLIANI, F., & MILLER, M. 1958. **The Cost of Capital, Corporation Finance and the theory of Investment**, American Economic Review, Vol. 48, N^{o} 3: 261-297. USA.

MOHAMMADZADEH, M., RAHIMI, F., RAHIMI, F., & AARABI, M. 2013. **The Effect of capital structure on the profitabilitas of pharmaceutical companies the case of Iran**. Iranian Journal of Pharmaceutical Research, Vol. 12, N^{o} 3: 573–577. Iran.

MURSALIM, M., & KUSUMA, H. 2017. **Capital Structure Determinants and Firms' Performance: Empirical Evidence From Thailand, Indonesia and Malaysia**. Polish Journal of Management Studies, Vol. 16, N^{o} 1: 154–164. Poland.

OZKAN, A. 2001. **Determinants of capital structure and adjustment to long run target: Evidence from UK company panel data**. Journal of Business Finance and Accounting, Vol. 28, No 1–2: 175–198. USA.

PANDEY, I. 2001. **Capital Structure and the Firm Characteristics: Evidence from an Emerging Market Capital Structure, Working paper**, Indian Institute of Management Ahmedabad, pp. 1–19. India.

SAAD, N. 2010. **Corporate Governance Compliance and the Effects to Capital Structure in Malaysia**. International Journal of Economics and Finance, Vol. 2, N° 1: 105–111. Canada.

SAARANI, N., & SHAHADAN, F. 2013. **The Comparison of Capital Structure Determinants between Small and Medium Enterprises (SMEs) and Large Firms in Malaysia**. International Journal of Economics and Finance Studies, Vol. 5, N° 1: 22–32. Turkey.

SHAWTARI, F., SALEM, M., HUSSAIN, H., ALAEDDIN, O., & THABIT, O. 2016. **Corporate governance characteristics and valuation: Inferences from quantile regression**. Journal of Economics, Finance and Administrative Science, Vol. 21, N° 41: 81-88. UK.

YUSUF M., YUNUS, F., & SUPAAT., N. 2013. **Determinants of Capital Structure in Malaysia Electrical and Electronic Sector**. International Journal of Social, Human Science and Engineering, Vol. 7, N° 6: 675–680. Iran.

ZABRI, S. 2012. the **Determinants of Capital Structure Among SMEs in Malaysia. Proceedings International Conference of Technology Management**, Business and Entrepreneurship, pp. 132–146. USA.

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