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Capital Structure, Firm Value and Insolvency Probability in the UK

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Abstract: *This paper applied the least square dummy variable (LSDV) or Fixed effect model (FEM) to estimate the effect of, and relationship between capital structure (gearing) on firm value and insolvency among UK companies for a period of twelve years (2005 – 2016). The sample includes all non-financial firms in the FTSE 100 index. The empirical findings from the test of hypotheses revealed that highly geared firms have lower values and higher likelihood of insolvency relative to lowly geared firms. Also, firm value is negatively, but not significantly related to insolvency. The results thus provide insight into efficient firms' capital structure decisions (gearing level) for the maximization of firm value and minimization of insolvency likelihood.*

Keywords: *Capital Structure, Gearing, Firm value, Insolvency, Financial Decision*

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I. Introduction

A successful investment decision is backed by a stronger and more accurate choice of capital structure. Debt – equity choice, otherwise known as capital structure is an important factor to be considered in making financial decisions that can withstand the volatilities in the financial market. Ogbulo and Emeni(2012) document that "capital structure decisions have various implications and one of them is its effect on the value of the firm, and the other being its implication on bankruptcy probability, which forms the basis of this research.

In the light of the above, a vast number of works have explored the debate on optimalcapital structure since the days of Modigliani and Miller in the late 1950s, Modigliani & Miller in the 1970s and Myers in the 2000s, till date. Despite the numerous attempts by scholars in corporate finance to come up with an optimal capital structure (best debt-equity choice), it appears that there is no right capital structure level, confirmed in the statement of Myers (2001) that "there is no universal theory of debt-equity choice and no reason to expect one". Again, the link between potential insolvency and debt-equity choice is still an area that is yet to be satisfactorily addressed in the capital structure literature. This has necessitated this study.

There are several papers that attempted to address the issue of Capital Structure Choice in various forms but just a hand full tried investigating the combined relationship between capital structure, firm value and insolvency. The Modigliani and Miller's proposition I states that a firm's market value is not dependent on its capital structure. In other words, there is no relation between the capital structure of a firm and its average cost of capital, but the latter is equal to the capitalization rate of a pure equity stream of its class (Muradoglu and Sivaprasad, 2010). The second proposition holds that both the unlevered firm and the leveraged firm have equal shareholders required rate of return (cost of equity) only if the former adds a premium for financial risk (Ogbulo and Emeni, 2012). Alternatively, Muradoglu and Sivaprasad (2010) contend that "the expected yield of a share is equal to the appropriate capitalization rate plus a premium related to financial risk equal to the debt-to equity ratio". Meaning that "though the value of a levered firm remains constant, the cost of equity increases due to the risk of debt"

This research adds up to the few that seek to investigate the combined effect of capital structure on firm value and insolvency by critically reviewing some related literature on debt-equity choice, firm value and insolvency,following Modigliani and Miller (1958, 1963, 1977), Baxter (1967), Myers (2001), Adrienn (2014) to ascertain the impact debt-equity choice have on firm value and insolvency.

II. Literature Review And Hypotheses Development

2.1Capital structure and Firm value

Pandey (2004) opines that the value of a firm is the sum of the values of all its securities. That is, the sum of its equity and debt if it's a leverage firm and the value of only its equity if it is an unleveraged firm. The value of the firm's equity is the discounted value of its shareholders' earnings called net income. That is, the net income divided by the equity capitalization rate or expected rate of return on equity. Ogbulo and Emeni (2012) advance that the capital structure of a firm is basically the debt equity mix of that firm. While equity is made up of paid-up share capital, share-premium, reserves and surplus and/or retained earnings, long term debt on the other hand, refers to all other debts that are due for payments in a year or more time.

The relationship between capital structure and firm's value can best be explained by a brief review of the different theories on capital structure. The traditionalist theories as well the irrelevance theory of Modigliani and Miller (1958)believe that capital structure is relevant in determining a firm's value, where the former considered a perfect market, and the later considered effect of tax shield and other imperfection in the capital market. The pecking order theory of Myers and Majluf (1984) state that there is a correlation between capital structure and firm's value because a firm's value can increase if the right form of capital is used. That is, financing with internal fund when available instead of financing with external fund. And when internal fund is completely depleted, debt should be preferred to equity because of the low transaction cost, tax benefits and other advantages attached to it. The trade-off theory also states that there is a relationship between capital structure and firm's value because firm's value can increase if the proper debt-equity mix is used in the firm.

Jensen (1986) posits that "when firms have more internally generated funds than positive net present value projects; debt forces the managers to pay out funds that might otherwise have been invested in negative net present value projects. This over-investment problem can be lessened if managers are forced to pay out excess funds for servicing debt, therefore enhancing the firm's value". Myers (1993) suggests that, "a firm with outstanding debt may have the incentive to reject projects that have positive net present value if the benefits from accepting the project accrue to the bondholders without also increasing shareholders' wealth. This under – investment problem can harm the value of firms, especially for the firms with high levels of future investment opportunities".

In the gearing literature, Modigliani and Miller (1963) demonstrate that when corporate tax laws allow the deductibility of interest payments, the market value of a firm is an increasing function of leverage. With corporate income tax rate and on an after-tax basis, firm value increases with the leverage, because interest is a tax-exempt expense. It means that firms can maximize their values by using more debt financing. "If companies use debts, their value of the firm can be increased by adding debts".Miller's (1977) incorporates the personal income tax (personal marginal tax rates for dividends and interests respectively) along with the corporation income tax to examine the gain from leverage for stockholders in a firm holding real assets. The market value of a highly-geared firm incorporating the effect of both corporate and personal taxes in his model shows thatthe despite the higher tax liabilities on interest at the personal level, the interest tax-shield benefit from leverage improves firm value. Fernandez (2005) adds that whether cost and risk of the leverage (highly-geared capital structure)areconsidered or not, the present value of the tax shields is always positive, leading to higher firm value. Therefore, we hypothesise:

H1: Firms with highly geared capital structure have higher values than firms with lowly geared capital structure

2.2 Capital structure and Insolvency

Any extension of credit payment periods by an individual or firm are indications of risk of timely payment. Individuals or firms show early signs of insolvency, when they are consistent in defaulting payment. But for the power granted debtors to seize and liquidate assets of defaulted creditors, no individual or organization would have engaged in long term borrowing (Amour, 2001). Baxter (1967) defines insolvency as "the inability of an individual or business firm to meet contractual financial obligations as they come due" and the Association of Business Recovery Professionals (2008) says: "A company is insolvent (unable to pay its debts) if it either does not have enough assets to cover its debts (i.e. value of assets is less than amount of liabilities), or if it is unable to pay its debts as they fall due". The common sense from both (Cash Flow) definitions is the inability of a firm to pay its debtors at an agreed time.

Belcher, (1997) defines a Balance Sheet Insolvency as an accounting concept that signifies the book value of a firm's assets is less that its liabilities. As the value of a firm reduces, it will get to a point where its liabilities are more than its assets and hence, it will be seen as insolvent.

Warner (1977) describes this to be a situation where a firm is unable to liquidate debt or suffering from deteriorating financial conditions. Wruck(1990) adds that in this situationthe firm's operating cash-flows are not sufficient to satisfy current obligations, and the firm is forced to take corrective actions. Warner(1977) and Kim(1978) explored the leverage level and bankruptcy probabilities and found that when increasing the level of

debt usage, the probability that a financial distress occurs is also expected to increase. In other words, their bankruptcy probabilities are certainly higher.

Higher calculations of agearing ratio indicate a company has higher degree of leverage and is more susceptible to downturns in the economy and in the business cycle. This is because firms that have higher gearing have higher amounts of debt to servicewhen compared to owner's equity. As described above by Modigliani and Miller (1958), if companies use debts, their value of the firm can be increased by adding debts. However, if debts keep increasing overtime, the companies' risks will be high, and the possibility of bankruptcy will emerge (high potential of insolvency). Therefore, there will be trade-off with cost of bankruptcy, if debts keep increasing. As the debts increase, the firm runs into a greater risk of defaulting in interest and principal which increases thepossibility of insolvency. Thus, we hypothesise:

H2: Firms with highly geared capital structure are associated with higher possibility of insolvency than firms with lowly geared capital structure

2.3 Firm Value and Insolvency

According to Altman (1968, 1993), the better the firm financial quality, the lower the insolvency and bankruptcy probability. Based on Leland (1994, 1998) model, the bankruptcy (insolvency) probability is a negative relationship with firm values. Thus, the firm value is an increasing function with the firm financial quality, but is a decreasing function with firm insolvency (bankruptcy probability) through debt financing. Cheng and Tzeng (2010) indicate that the positive influence of leverage to firm value tends to be stronger when firm financial quality is better. Since insolvency reduce firm value, then, a firm's debt value has a negative relationship with its insolvency (otherwise bankruptcy probability). Firms with a higher bankruptcy probability will be demanded to pay higher interest on debt and comply with more constrains in debt covenants. The demands may further increase the firm's insolvency probability, thus further reducing firm value. Therefore, we hypothesize:

H3: Firms value is negatively related to insolvency

III. Data And Methodology

3.1 Data

This research used non-financial annual UK data of FTSE 100 firms listed on London Stock Exchange (LSE) for the period between 2005 to 2016 obtained from Bloomberg. The sample in this study consisted of 80 non-financial companies in FTSE 100 that provide annual report from 2005 to 2016 consecutively. For accurate analysis, firm-year observations that did not have data of the variables studied were deleted. As a result, 28 firm year observations were deleted, leaving 932 firm-year observations for analysis. However, due to using cross section fixed (dummy variable) model, the final sample is 922 firm-year observations. The analysis is performed using Eviews 9.5.

Design and Model Specification

This study adopted an explanatory non-experimental research design to investigate the relationship between capital structure, firm value and insolvency. Explanatory research seeks to establish causal relationship between variables (Saunders et al., 2009 & Robson 2002). According to Kerlinger and Lee (2000) an explanatory non-experimental research design is appropriate where the researcher is attempting to explain how phenomenon operates, by identifying the underlying 'non-manipulated' factors that produces change in it.

In this study, the least square dummy variable (LSDV) or fixed effect model (FEM) is employed to estimate the relationship between the variables in the formulated hypotheses using pooled cross-section and time-series data (unbalanced panel data). This study builds regression models in accordance to prior works of Cheng and Tzeng (2011) and Ramadan (2016).

Hypothesis 1, to validate the claim that firms with highly geared capital structure have higher values than firms with lowly geared capital structure, we regress firm value as the dependent variable on gearing level (high or low using intercept and slope dummy) as well as control variables contained in previous works.

$$FV_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 GEAR_{it} + \beta_3 D*GEAR_{it} + \rho_i X_{it} + \varepsilon_{it}$$

Where FV denotes fair value (see definition in section 3.3), D=1 if the firm is highly geared and Zero otherwise, GEAR denotes gearing or capital structure measured as firm debt divided by firm debt plus equity (all in firm i at time t), and X denotes the vector of controls which include firm size (log of assets), Earnings per share (EPS), Capital expenditure (CAPEX) and Firm Revenue. The coefficient on the interaction term (D*GEAR) measures the average incremental firm value for highly geared firms, which we expect to be higher than the coefficient of the non-interaction term (GEAR) measuring lowly geared firms, i.e. $\beta_3>0$ (statistically significant) and $\beta_3>\beta_2$ (higher firm value), t-statistics > 1.96 (which indicates significant at the 1% level), H1 is confirmed. If $\beta_3<=\beta_2$ with t-statistics < 1.96, then H1 is rejected.

Hypothesis 2, to validate the proposition that highly geared capital structure is associated with higher possibility of insolvency than lowly geared capital structure, we regress insolvency as the dependent variable on gearing level (high or low using intercept and slope dummy) as well as control variables contained in previous works.

$INSOLV_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 GEAR_{it} + \beta_3 D*GEAR_{it} + \rho_i X_{it} + \varepsilon_{it}$

Where INSOLV denotes insolvency (see definition in section 3.3), D=1 if the firm is highly geared and Zero otherwise, GEAR denotes gearing or capital structure measured as firm debt divided by firm debt plus equity (all in firm i at time t), and X denotes the vector of controls which include firm size (log of assets), Earnings per share (EPS), Capital expenditure (CAPEX) and Firm cost. The coefficient on the interaction term (D*GEAR) measures the average incremental likelihood of insolvency for highly geared firms, which we expect to be higher than the coefficient of the non-interaction term (GEAR) measuring lowly geared firms (since highly-geared capital structure has a higher possibility of insolvency), i.e. $\beta_3 > \beta_2$ (higher possibility of insolvency and bankruptcy for highly-geared firms relative to lowly-geared firms), H2 is confirmed. However, if $\beta_3 <= \beta_2$, then H2 is rejected.

Hypothesis 3, to validate that firm value is negatively related to insolvency or positively related to solvency, we regress solvency as the dependent variable on solvency as well as control variables contained in previous works.

$FV_{it} = \beta_0 + \beta_1 INSOLV_{it} + \rho_i X_{it} + \varepsilon_{it}$

Where FV denotes fair value (see definition in section 3.3), INSOLV denotes solvency (see definition in section 3.3) and X denotes the vector of controls which include firm size (log of assets), Earnings per share (EPS), Capital expenditure (CAPEX) and Firm Revenue. The coefficient on the INSOLV measures the average effect of insolvencyon firm value for firms, which we expect to be significant and positive (showing that the higher the firm value, the lower the insolvency and vice versa- a negative relation between firm value and insolvency), $\beta_1 < 0$ (negative and statistically significant), t-statistics > 1.645 (which indicates significant at the 5% level), H3 is confirmed. If $\beta_1 > 0$ with t-statistics < 1.645, then H3 is rejected.

Where the variables are defined as:

a. Firm value is measured as enterprise value which is a market based proxy of firm value obtained from Bloomberg.

b. Insolvency is measured as the reverse of solvency ratio.

$$\text{Solvency Ratio} = \frac{\text{Net Income (or After-Tax Profit)} + \text{Depreciation}}{\text{Short-Term Liabilities} + \text{Long-term Liabilities}}$$

c. The gearing ratio measures firms financial leverage mathematically expressed as:

Gearing ratio = firm debt / (firm equity + firm debt)

With firm debt representing all long-term debt of a firm, and the equity representing the book value of ordinary share capital, share premium, reserves, retained earnings, and other equity components. A highly-geared ratio of above 50% is represented as D=1, while firms with gearing ratio less than 50% are given D=0

d. Control vectors employed include firm size (log of assets), Earnings Per Share (EPS), Capital expenditure (log of fixed assets), firm revenue (log of Operating Revenue) and firm cost (log of operating cost).

IV. Findings

This section reports the result of panel regression undertaken to test the hypotheses formulated in this study.

4.1 Capital structure and Firm Value

Table 1: *Cross-Sectional Regression Results of capital structure and Firm value, moderated by control variables*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.447735	1.774646	4.196745	0.0000
D	0.330502	0.324613	1.018142	0.3089
GEAR	0.350900	0.462297	0.759036	0.4480
D*GEAR	-0.636514	0.557087	-1.142576	0.2535
FSIZE	-0.898368	0.221497	-4.055887	0.0001
EPS	0.099703	0.052148	1.911935	0.0562
FREV	0.051813	0.161882	0.320064	0.7490
FCAP	0.343163	0.128846	2.663353	0.0079

The regression results suggest that highly geared firms have lower firm values with D*Gear having a negative coefficient of 0.6365, indicating that as firms keep increasing the level of gearing (highly geared capital structure), firm value decreases by 63.65%. An explanation to this is the trade-off theory which posits that firm values increase with increase of debt until the marginal benefits from leverage equal to the marginal bankruptcy costs, at this point, the firm's value reaches its maximum level. If there is a further increase the level of debt usages, firm value decreases rapidly. This observation is similar to Myers (2001) who found that borrowing that is not moderated lowers the value of such firms.

Another explanation for the negative relation between highly-geared capital structure and firm value draws root from the agency theory of asset substitute effect which holds that as debt to equity increases, management has an increased incentive to undertake risky projects (because of the availability of excess money from debt financing). These risky projects which are often hyped have high unsuccessful chances, which significantly reduce firm values.

The test results show that the coefficient of the interaction term $\beta_3(-0.6365)<\beta_2(0.3509)$. Thus, H1 is rejectedand it is upheld that firms with highly geared capital structure have lower values than firms with lowly geared capital structure. This result agrees with Aggarwal, Kyaw and Zhao (2012). A reason for this could be that low geared firms have more opportunities to increase leverage (external financing to meet their investment requirements) and this is priced positively by the market, which value is increasing for such firms.

Also, the benefits of excess debt financing (tax shields)for highly-geared firms falls below the cost associated with such financing option (interest, agency costs and bankruptcy costs), thus reducing the value of highly-geared firms. This contradicts the findings of Fernandez (2005) and Cheng and Tzeng (2010) who found that whether cost and risk of the leverage (highly-geared capital structure) are considered or not, the present value of the tax shields is always positive, leading to higher firm value.

Capital Structure and Insolvency

Table 2: *Cross-Sectional Regression Results of capital structure and Insolvency, moderated by control variables*

Dependent Variable: INSOLV

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	48.96861	52.29820	0.936335	0.3494
D	-6.227798	9.344951	-0.666435	0.5053
GEAR	-13.48168	13.32284	-1.011922	0.3119
D*GEAR	12.10451	16.10677	0.751517	0.4526
FSIZE	-1.351180	6.438913	-0.209846	0.8338
FREV	-1.988411	4.674646	-0.425361	0.6707
FOC	-1.222511	11.72389	-0.104275	0.9170
FCAP	-4.646975	3.731602	-1.245303	0.2134

The regression results show that highly geared firms have higherlikelihood of insolvency with D*Gear having a positive coefficient of 12.10, indicating that as firms keep increasing the level of gearing (highly geared capital structure), firm possibility of insolvency increases by 12.10 times. An explanation for this could be that as the debts increase of highly geared firms, these firms run into a greater risk of defaulting in interest and principal which increases the possibility of insolvency.This finding agrees with Cheng and Tzeng (2010).

The test results show that the coefficient of the interaction term $\beta_3(12.10451)>\beta_2(-13.48168)$. Thus, H2 is accepted, and it is upheld that firms with highly geared capital structure have higher likelihood of insolvency than firms with lowly geared capital structure.

A reason for this could be because as firms use more debts in their capital structure, it is more likely to have financial distress where they are unable to liquidate debt because the probability of financial distress occurring is also expected to increase with increase in debt usage.

Firm value and Insolvency

Table 3: *Cross-Sectional Regression Results of Firm value and Insolvency, moderated by control variables*

Dependent Variable: FV

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.277685	1.768560	4.115033	0.0000
INSOLV	-0.000691	0.001207	0.572499	0.5671
FSIZE	-0.875962	0.219075	-3.998466	0.0001
EPS	0.096464	0.051428	1.875698	0.0610
FREV	0.045882	0.161431	0.284218	0.7763
FCAP	0.354755	0.128268	2.765726	0.0058

The regression results show that insolvency is inversely related with firm value. Firms with higher values have lower possibility of insolvency. When the probability of insolvency rises by 1 percent, firm value falls by 0.0691 percent. This impact is not statistically significant.

The test results show that the coefficient of INSOLV is negative, i.e. β_1(-0.000691), but not significant at 5% level of significance, i.e. calculated t-statistics(0.5671) <critical t-statistics (1.96). Thus, since the inverse relationship between firm value and insolvency probability is not statistically significant, the coefficient of INSOLV is regarded not to be statistically different from zero, hence, H3 is rejected. It is therefore upheld that firm value is negatively related to insolvency probability of firms in FTSE 100. However, the negative relationship between them is not statistically significant. This negative relationship conforms to the findings of Cheng and Tzeng (2010).

V. Conclusion

Gearing (Leverage) has been recognized as a vital discuss in capital structure literature. Gearing helps companies maintain optimal capital structure for improving firm value, and provides tax shields. Though improving firm value and ensuring that firms take advantage of tax shields, it is associated with great risk. This risk can significantly reduce firm value and increase the likelihood of firms' insolvency when unchecked.

The trade-off theory and Pecking order theory reveal that the total benefit of debt must be matched against the total cost of debt if a firm wants to reap the benefit of increasing value from its gearing level.This analysis of the relationship between firm value, gearing level and gearing cost/benefits is of great importance to firms in emerging markets because the maximizing-value firm will not use its debt to equity ratio in excess of the optimal capital structure.Firms that use more debt in their capital structure will likely face financial distress, arising from their inability to liquidate excessive debt and the interest thereon, depleting firm value.

Furthermore, firms with better financial quality have lower insolvency likelihood and higher firm value. Thus, firm value is an increasing function with firm financial quality, but a decreasing function with firm insolvency through debt financing; hence resulting in a negative relation between firm value and insolvency probability. This conforms to Chen and Tzeng (2011).

In conclusion, the results of the first and second hypotheses tested in this study reveal that highly-geared firms have lower firm values and higher likelihood of insolvency compared to lowly-geared firms.Our third hypothesis further revealsthat firm value is negatively related with probability of insolvency, though the relationship is not significant.

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