A Study of the Relationship between Free Cash Flow and Debt

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Abstract: The increasing expansion and complexity of economic activities on the one hand and the necessity to provide accurate accounting information on the other underline the necessity of doing research on accounting issues. The results of these studies can serve as a tool for the accounting community for providing transparent information. Financial statements are the best means for providing financial information to users that helps them in making financial decisions. Financial statements must present a record of the financial activities of a business or entity in a structured fashion. Financial statements must include statement of cash flows. Considering the importance of free cash in repaying debts and liabilities, we decided to examine the relationship between free cash flow and debt in the firms listed in Tehran Stock Exchange.

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1. Introduction

Statement of cash flow is one of the financial reports that are presented to investors. This statement, along with other information in financial statements, can be useful in evaluating debt capacity, liquidity, and financial flexibility. A more complex way of determining the financial flexibility of a business is to analyze its free cash flow. Free cash flow (FCF) is the amount of cash available to a business that can be used in making investments (acquiring other entities or investing in stock exchange), payment of dividend, repaying debts, or increasing liquidity. In other words, this measure reflects the financial flexibility of the company.

Market reaction to debt issues

Chaplinsky and Hansen (1993) carried out a research on market reaction to straight debt issues. They found negative stock returns for up to 140 days before the issue announcement and their findings were consistent with market anticipation hypothesis. Johnson (1995) examined the relationship between leverage, free cash flow, and debt issues for the period 1977-1993. By separating low-dividend-payout and high-dividend-payout firms, Johnson provided evidence that low-dividend-payout firms have significantly positive stock price effects at the announcement of a debt offering. In addition, Jensen (1986) showed that dividends are not necessarily the best tool for obliging manages to pay out future free cash flows, for dividends are paid at the discretion of managers. Jensen argued that there is high agency cost of free cash flow when managers have large cash flows and few investment opportunities.

Howton et al. (1998) measured the market reaction to 937 straight debt issues between 1983 and 1993 with respect to free cash flows and investment opportunities. They argued that leverage-increasing events should increase firm value because of a reduction in agency costs associated with free cash flow. This result is expected in most cases when leverage is increased because debt binds firms to make future cash payouts. Straight debt issues are expected to increase the free cash flow available to a manager of a firm as these issues make additional cash available to managers to be used at their discretion. Howton et al. (1998) found that the market reaction to a straight debt issue is directly related to the issuing firm's level of existing cash and inversely related to the issuing firm's investment opportunities.

Many researchers have used the method of Lehn and Poulsen (1989) for measuring free cash flow. They measure FCF as operating income before depreciation minus taxes, interest expenses, preferred and common dividends, and taxes. Also Tobin's Q is used as a measure for investment opportunities. Tobin's Q is the ratio of the market value of a firm's assets to the book value of the assets. Firms with high Tobin's Q are predicted by market to have more investment opportunities in the future. Thus, firms can be classified as firms with high/low Q and high/low FCF. The median is used for classifying the firms. For instance, firms with high Tobin's Q are those whose Q is higher than the median Q of the sample. In addition to the main variables, several control variables were also examined, including debt to book value of assets ratio, yield to maturity, etc.

They argued that the reason for adding these variables is to calculate cross-sectional differences in debt issues. Researchers collected all the required data from Compustat database and used market model to calculate abnormal return for both sides of debt issues. Abnormal return (AR_{it}) for the firm i on day t is defined as follows:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt})$$

where:
R_{it} = return of company i on day t

α_i & β_i = estimates of firm i 's market model parameters
R_{mt} = daily return on the CRSP value-weighted market index over day t

Abnormal return is calculated by using the above equation for a period of 21 days that starts 10 days before the announcement date. The average abnormal returns for all the sample firms (AR_t) is defined as follows:

$$AR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it}$$

N denotes the number of sample firms. Mean difference test was used to calculate average abnormal returns during the announcement period and the results related to day 0 for four groups of sample firms are presented below:

Table 1. Group

Group	Mean Abnormal Return	Standard Deviation	t	P-Value
High Q	-0.565	0.024	2.251	0.025
Low Q	-0.239	0.020		
High FCF	-0.410	0.025	0.307	0.759
Low FCF	-0.365	0.020		

Researchers expect that upon debt issue, firms with large free cash flow and few investment opportunities will have lower abnormal returns than similar firms with low free cash flow. Regression analysis is used to examine the relationship between the standardized abnormal return on the announcement day (day 0), proxies of free cash flow, investment opportunities, and several other control variables:

$$SAR_{in} = \&_0 + \&_1 Q_i + \&_2 CF_i + \&_3 YLD_i + \&_4 AMT_i + \&_5 DA_i + \&_6 QUA_i + \varepsilon_i$$

SAR = standardized abnormal return for firm i on day 0

Q = proxy of investment opportunities

CF = cash flow divided by the book value of total assets

YLD = debt yield to maturity

AMT = debt issue in dollars

DA = debt to book value of total assets ratio for firm i

QUAL = quality

$\&_{0-6}$= estimated parameters

ε = error coefficient

Estimation of this regression model provides insight into the relationship between abnormal return upon debt announcement and free cash flow. Firms with more investment opportunities are probably less faced with the agency problems associated with free cash flow. On the other hand, the stockholders of firms with large free cash flow do not welcome debt announcement which brings excess funds under the control of the management. This suggests that stockholders of such firms react negatively to debt issuance and this leads to the negative response of market to the debt announcement. In general, the researchers found that market response to debt issuance is directly associated with the level of free cash available to a firm and indirectly associated with the debt issuing firm's investment opportunities.

Investment opportunities, debt, and dividend policies

Gul and Kealey (1999) carried out a research to examine the relationship between investment opportunity set, corporate debt, and dividend policies in Korean companies. To analyze investment opportunities, the researchers used the following measures:

(1) $$MBASSET = \frac{ASSETS - BVE + MVE}{ASSETS}$$

(2) $$MBEQUITY = \frac{MVE}{BVE}$$

(3) $$EP = \frac{EPS}{PRICE}$$

where ASSETS is total book value of assets, BE is total book value of common equity, MVE is total market value of common equity, EPS is primary earnings per-share before extraordinary items, and PRICE is closing price of common stocks. Moreover, debt and dividend policies were measured by the following measures:

(4) $$BOOKLEVG = \frac{\text{Total Liabilities}}{\text{Book Value of Equity}}$$

(5) $$MRKTLEVG = \frac{\text{Total Liabilities}}{\text{Market Value of Equity}}$$

$$PAYOUT = \frac{\text{Dividends per Share}}{\text{Earnings per Share before Extraordinary Items}} \quad (6)$$

$$YIELD = \frac{\text{Dividends per Share}}{\text{Price per Share}} \quad (7)$$

Using factor analysis of the measures 1 to 3, they calculated a common measure that served as a proxy for IOS. In terms of debt policies, firms were ranked as growth or non-growth firms based on top and bottom quartile of the ranked factor analysis, and regression analysis was applied to test the relationship between the variables. This study supported the theory that there is a negative association between investment opportunity set, corporate debt, and dividend policies.

Free cash flow, debt, and audit fees

Gul and Tsui (1998) examined the relationship between free cash flow and audit fees in low growth firms. They divided their sample into firms with high and low debt and used regression analysis to examine the relationship between the variables. The variables of the research were defined as follows:

Growth opportunities: They employed the proxies defined by Chung and Charoenwong (1991), Gaver and Gaver (1993), and Skinner (1993). These proxies are:

- The ratio of the market value of equity to the book value of equity (MKTBKEQ). This proxy is used because the difference between the market value and the book value of equity incorporates the value of the firm's future investment opportunities. The higher the ratio, the greater the value of growth opportunities.
- The ratio of the market value of assets to the book value of assets (MKTBKASS). The higher the ratio, the lower the ratio of assets-in-place to the firm value and the greater the value of growth opportunities.
- The ratio of gross plant, property and equipment to the market value of the firm (PPE).

Lehn and (1989) carried out a research on free cash flow and stockholder gains in going to private transactions. Examining a sample of public firms that were going private between 1980 and 1987, they found evidence in support of Jensen's free cash flow hypothesis and came to the conclusion that:

1. Undistributed cash flow is significantly related to a firm's decision for going private
2. Premiums paid to stockholders are significantly related to undistributed cash flow.

Also Jensen (1986) argued that managers with substantial free cash flow can increase dividends or repurchase stock and thereby pay out current cash that would otherwise be invested in low-return projects or wasted.

Goyal et al. (2001) examined five widely used proxies for growth opportunities: (1) the ratio of the market value of a firm's assets to the book value of its assets, (2) the ratio of the market value of equity to the book value of equity (MBE), (3) the earnings-to-price ratio (EPR), (4) the ratio of capital expenditures to the book value of assets at yearend (CAPEX), and (5) the ratio of research and development expenditures to the book value of assets at yearend (R&D). They came to the conclusion that MBE has the most important information content as compared to the other proxies.

Methodology

The present research is applied in which two hypotheses are formulated to examine the relationship between free cash flow and debt. The required data was collected from Tehran Stock Exchange (TSE) and DenaSahm Software. Principal component analysis, correlation matrix, and regression analysis were used for hypothesis testing. In the first hypothesis, investment opportunity set (IOS) of firms for a period of five years is described using mean, median, and quartile. Then, correlation matrix and Eigen values are employed to create a common measure that will represent the relationship between the variables. Firms are divided into low growth and high growth firms based on their investment opportunities and considering the research hypothesis, low growth firms are selected. In the second hypothesis, firms are divided into large and small based on firm size variable. Finally in both hypotheses the relationship between free cash flow (FCF) and debt (DE) is examined for the selected firms from the regression model.

Population and sample

The population of the present research consists of all the firms listed in Tehran Stock Exchange (TSE). Based on the financial statement journal published by TSE every three years as well as DenaSahm Software that includes the financial information of the firms listed in TSE, 256 firms form the population of the research. Our aim was to examine all these firms, but the sample firms must have presented their financial statements for the 5-year study period. Thus, the sample is selected as follows:

A. Firms must have been listed in TSE since 1996 and have provided their financial statements for the period 1996-2000.
B. The required data that are extracted from financial statements and notes must be complete and accessible.

The sampling thus involves omitting those firms that do not meet these conditions from the sample. In the end, the data on only 86 firms was fully accessible and these firms were selected and studied as the sample.

Investment opportunity set (IOS): IOS is an intangible variable that needs the right proxy for experimental analysis. Sometimes growth is used as a proxy for IOS, but the reliability of this variable is subject to discussion. Nonetheless, we use three widely used measures associated with IOS for examining investment opportunities:

(1) $MKTBKEQ = \frac{\text{Market Value of Equity}}{\text{Book Value of Equity}}$

(2) $MKTBKAS = \frac{\text{Market Value of Assets}}{\text{Book Value of Assets}}$

(3) $EPS/Price = \frac{\text{Earnings per Share}}{\text{Share Price}}$

These measures can reflect the value of future investment opportunities of firms, since the difference between the market and book value of assets and equity as well as earnings and price of each share play a significant role in the future growth of firms.

Market value of assets: This variable is obtained from the sum of market value of equity and book value of debt.

Share price: Share price is the last price of each share at the end of the fiscal year reflected on the exchange bulletin and TSE journals.

Data collection

One of the main variables of the research is FCF and we need depreciation expense in order to calculate it. These expenses are only reported in notes to financial statements. Thus, the notes related to the period 1996-2000 of the sample firms were used for collecting the data related to this variable. Other data such as annual operating income, dividend, earnings per share, share price, book and market value of assets, and book and market value of equity were extracted from financial statements, financial information journal published by TSE, and DenaSahm Software.

Table 2 – Results of analysis of variance

Source of Variance	Sum of Squares	DOF	Mean Squares	F	P
Treatment	SSR	1	$MSR = SSR$	MSR/MSE	
Error	SSE	$n-2$	$MSR = \frac{SSE}{n-1}$		
Total	SST	$n-1$			

Results

Testing the first hypothesis

H1: There is a significant relationship between free cash flow and debt in firms with few investment opportunities.

Investment opportunity set is a variable that depends on several measures and these measures must be analyzed in order to calculate this variable:

1. Market to book value of assets ratio (MKTBKEQ)
2. Market to book value of equity ratio (MKTBKAS)
3. Earnings per share to share price ratio (EPS/Price)

First, using descriptive statistics we calculate the mean, median, maximum, minimum, first quartile, and third quartile of these measures. Then, using principal component analysis and correlation matrix, these measures are incorporated into one common variable (IOS) that serves as a proxy for investment opportunities.

Table 3 – Descriptive statistics of the measures of IOS

Variable	N	Mean	Median	Min	Max	Q1	Q3
MKTBKEQ	86	1.6433	1.4956	0.853	4.7182	1.2814	1.778
MKTBKAS	86	3.2603	2.6126	1.0838	13.4556	1.9932	3.876
EPS/Price	86	0.2658	0.2617	0.102	0.638	0.2236	0.3028

The results of applying correlation matrix in Minitab 11 software are shown in the table below.

Table 4 – Eigenvalues of the correlation matrix

Eigenvalue	1.6643	1.0004	0.3353
Proportion	0.555	0.333	0.112
Cumulative	0.555	0.888	1.000
Variable	PC1	PC2	PC3
MKTBKEQ	0.707	-0.005	-0.707
MKTBKAS	0.706	0.059	-0.706
EPS/Price	-0.038	0.998	0.045

In the first part of the table the eigenvalues of the correlation matrix are obtained and based on principal component analysis, the first component with the highest value is taken as the common factor. The reason for choosing this component is that it accounts for the largest possible variability in the data. Based on the data in Table 4, 55% of the variance of the population is explained by the first component and thus this component is selected as the proxy for investment opportunities. In the second part of the table, the coefficients of MKTBKEQ, MKTBKAS, and EPS/Price (presented in the equation as A, B, and C respectively) are calculated. Since the first component is selected, the IOS equation for each firm can be defined as follows:

$$IOS = 0.707A + 0.706B - 0.038C$$

Using descriptive statistics, the mean, median, first and third quartiles, minimum, and maximum of IOS values are calculated.

Table 5 – Descriptive statistics related to IOS of the firms

Variable	N	Mean	Median	Tr Mean	SD	SE Mean	Min	Max	Q1	Q2
IOS	86	0.000	-0.407	-0.129	1.290	0.139	-1.479	5.978	-0.787	0.396

In this hypothesis, the firms are divided into two groups based on the median IOS. Firms with investment opportunities lower than median IOS are considered low IOS firms and are selected for hypothesis testing. The reason for choosing the median for grouping firms is that, unlike mean, median is not affected by outliers. 43 firms were selected for hypothesis testing and the data is presented in tables below. Table 6 presents the descriptive statistics related to debt and free cash flow of the selected firms.

Table 6 – Descriptive statistics related to DE and FCF of low IOS firms

Variable	N	Mean	Median	Min	Max	Q1	Q3
Debt	43	1.4698	1.1018	0.2638	9.2036	0.701	1.55
FCF	43	0.1034	0.091	0.0082	0.3214	0.0496	0.1186

After selecting the firms with low IOS, the relationship between debt and free cash flow in these firms was examined using a regression model. The results of the regression test for the first hypothesis are presented in Table 7. The regression model is as follows:

$$DE_1 = 0.0847 + 0.0178\,FCF_1$$

Table 7 – The results of the regression model for the first hypothesis

Predictor	Coefficient	SD	T	P
Constant	0.08471	0.01694	5.00	0.000
FCF1	0.017827	0.008213	2.17	0.036

Notes: S = 0.07787; R^2 = 10.3%; Adj. R^2 = 8.1%

Table 8 – Analysis of variance

Source	DF	SS	MS	F	D
Regression	1	0.028567	0.028567	4.71	0.036
Error	42	0.248595	0.006003		
Total	43	0.277163			

For both hypotheses, the error level is considered to be 5% ($\alpha = 0.05$ significance level), that is, 95% confidence interval. Therefore, H1 is rejected if P-value is greater than α and accepted if P-value is less than α. Since the P-value is 3.6% (less than α), the first hypothesis can be accepted at $\alpha = 0.05$. It can thus be concluded that there is a significant relationship between free cash flow and debt in firms with few investment opportunities at $\alpha = 0.05$.

Testing the second hypothesis

H2: There is a significant relationship between free cash flow and debt in large firms.

First, the firms are divided into small and large firms based on their size (total assets) and then large firms are selected for hypothesis testing. We use median for this classification as well. 43 large firms whose size is greater than the median of the sample are selected for testing the second hypothesis. The descriptive statistics related to this classification are presented in the table below.

Table 9 – The descriptive statistics related to the second hypothesis

Variable	N	Mean	Median	Min	Max	Q1	Q3
FSize	86	33091	112349	3973	10258838	44817	212665
Debt	43	1.1056	0.8265	0.2741	3.4232	0.6016	1.4082
FCF	43	0.0706	0.0694	-0.0078	0.3214	0.0272	0.105

After selecting large firms, regression model is used for hypothesis testing and the results are presented in Table 10. The regression model is as follows:

$$DE_2 = 0.0457 + 0.0362\,FCF_2$$

Table 11 – The results of the regression model for the second hypothesis

X

Table 12 – Analysis of variance

Source	DF	SS	MS	F	D
Regression	1	0.030034	0.030034	4.099	0.031
Error	42	0.246617	0.006015		
Total	43	0.276651			

Since the P-value in this hypothesis (3.1%) is less than the significance level (5%), the second hypothesis is accepted and it can be concluded that there is a significant relationship between free cash flow and debt in large firms at $\alpha = 0.05$.

Discussion and Conclusion

The purpose of the present research was to examine the relationship between free cash flow and debt with respect to investment opportunities and firm size. Considering the views of Jensen (1986) that are supported by many researchers (e.g. Jaggi & Gul, 1999; Gul & Kealey, 1999; Gul & Tsui, 1998), high levels of free cash flow are expected in firms with few investment opportunities. Moreover, debt is expected to be high in large firms due to their extensive debt capacity. The present research also

uses this theory and examines the relationship between free cash flow and debt using two hypotheses: (1) there is a significant relationship between free cash flow and debt in firms with few investment opportunities, and (2) there is a significant relationship between free cash flow and debt in large firms. The research covered the period between 1996 and 2000 and the population consisted of the firms listed in TSE. Principal component analysis, correlation matrix, and regression analysis were used for hypothesis testing. The results showed that there is a significant relationship between free cash flow and debt in low IOS firms at $\alpha = 0.05$. Considering the positive slope of the regression line ($b > 0$), this relationship is positive. It was also shown that there is a significant relationship between free cash flow and debt in large firms. The slope of the regression line is again positive, suggesting the positive relationship between these two variables. In general, the results of the present research are consisted with the findings of Jaggi and Gul (1999) and Gul and Kealey (1999) and support the theory of Jensen (1986).

Firm managers are recommended to analyze investment opportunities before making decisions about distribution of funds as dividend among stockholders and to avoid distribution of free cash in case there are profitable projects for investment. That is because investment in positive net present value projects increases the wealth of stockholders.

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