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Capital raising of aerospace companies: equities or debts?

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Abstract. Aerospace products enhance national and economic activities, thus maintaining the sustainability of aerospace industry is crucial. One of the perspectives in ensuring sustainability of aerospace companies is expansion of firms by raising funds for research and development in order to provide a reasonable profitability to the firms. This study comprises a sample of 47 aerospace companies from 2009 to 2015 to analyze the impact of raising fund by equities or debts to the profitability of the firms. The result indicates that capital raising through equities is preferable than debts. Moreover, the study also identifies that the profit of aerospace industry is volatile and there is cyclical reduction of the net income in the first quarter of the year. The management needs to make wise decisions in raising fund to ensure a healthy growth of the aerospace company.

1. Introduction

There is a continued interest on capital raising within the increasingly competitive and global business environment, especially in aerospace industry, to remain in the market with reasonable profit. With the fact that aerospace has been a capital-intensive industry, the focus in financing activities in aerospace industry is mainly on financing aircraft with the availability of financing alternatives such as equity financing or debt financing. It was pointed out that the significance of individual options of financing may fluctuate over time as the crumple of Lehman Brothers in 2008 triggered the financial market crisis [1]. Apart from the core strategy in research and development, the development of the supply side structure in aerospace industry needs to rely on capital funding. Capital budgeting has evolved into crucial determinant for the expansion formation in the aerospace industry. Hence, the accessibility of financing sources could constitute a realistic barrier to the market entry in the aerospace industry. Wojahn (2012) highlighted that in the recent decades, the aerospace industry has not even come close to attain an adequate level of profit where losses have spread from North America to all geographical regions in the world and cyclical losses have become structural [2]. However, with the difficulty in sustaining profitability, this industry still carries on to add capacity.

Among the questions raised include whether financing the further expansion of aerospace industry through equity market or capital market is more appropriate? Due to the magnitude of debt and also declining assets values in compelling the bank crisis and private sector such as aerospace sector's de-leveraging, the recent slump in the economy activity was illustrated as "balance sheet recession" [3]. This is because the de-leveraging will lead to a crash in bank lending and also influence customers' demand. The issue of correcting balance sheet could have long lasting impacts on economic growth and by consequence on the aerospace industry demand. Pearce (2012) presented that Japan is one of the country has most previous incident of such a balance sheet recession [4]. It demonstrated that addressing the bad debts of the banking system and the impact of collapsed equity and house asset

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values on private balance sheets had resulted in a decade of weak economic growth. It also highlighted that studies to achieve financial sustainability in aerospace industry are needed for future expansion purposes as well as the measures to attract new equity capital in this industry.

From Figure 1, in between the period of 2009Q1 to 2015Q4, average debt-capital financing from 47 aerospace companies worldwide is more than USD 4 billions whereas the average equity financing is less than USD 2 billions. This shows the trend that most aerospace companies rely on debt financing more than equity financing. The issue here is, which alternative is a profitable investment opportunity? Studies such as by Keuschnigg *et al.* (2013) [5], Aghion *et al.* (2007) [6], Tirole (2001) [7] and also Hubbard (1998) [8] postulated that many firms are facing dilemma in financing constraints that cause them to avoid from advancing business prospect with profitable investment opportunities. However, there is still lack of literatures that study the influence of debt financing and equity financing to the profit of the aerospace companies. In view of this, the work in this paper will assess the relationship between net incomes, revenues, total liabilities and total equities in the aerospace industry. To be more specific, this paper entails two main objectives. Firstly, it examines whether liabilities or equities will aid the aerospace companies to expand the business in return with higher profit. Secondly, it aims to investigate is there any cyclical loss in aerospace industry as suggested in [2], the loss due to structural change will influence the sustainability of the aerospace industry. This study differs from previous literatures that it endeavours to look into the finance determinants instead of technical issues related to aerospace, which will influence the profit of the aerospace firms to sustain in the market.

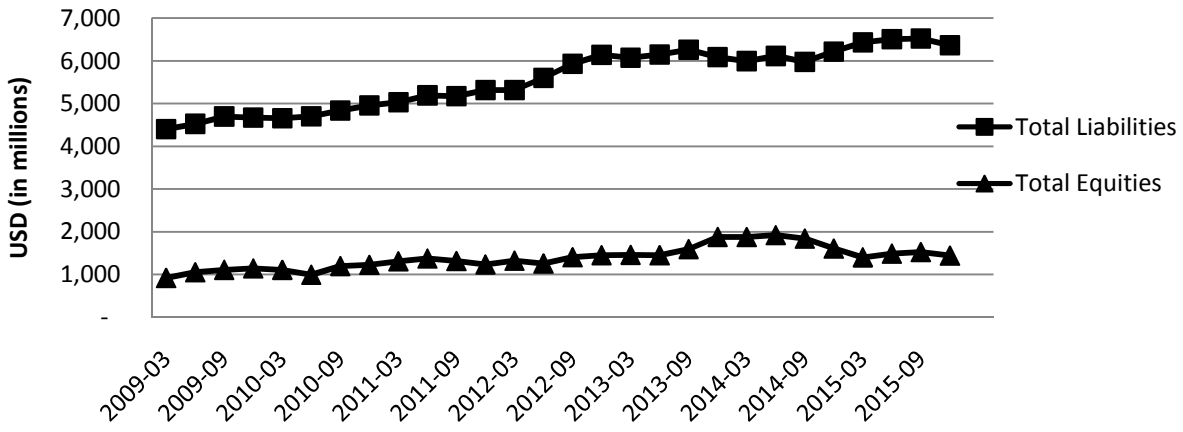


Figure 1. Average total liabilities and total equities in aerospace industry

This paper is organised as follows. In the next section, relevant literatures will be reviewed. Section 3 lays out the data and also methodology. Meanwhile, section 4 presents data and discussion on the results. Finally, section 5 provides a summary of the main findings.

2. Literature reviews

The attributes that affect business activities in airline industry had been investigated in [9]. It revealed that the airline industry is not only affected by the national characteristics but it is also influenced by internationalisation processes and international standards. The factors that had been recognised were airline alliances, national culture, implementation of business model and also consequences of market liberalization. The implication of this study served as a helpful means to potential synergies analysis. This research is focus on the operation management but not the financial management on the airline industry. Studies on the systematic risk in aviation were done by analyzing factors such as financial and operating leverage, firm size, profitability and liquidity [10, 11]. The study was later expanded by investigating the systematic financial risk exposure of the aviation industry with 5-factor asset pricing model and it was found out that the risk is positively significant to profitability and operating leverage, which resulted in negative earnings growth [12]. Nevertheless, their studies on financial management of aviation industry used financial leverage that was only focused on debts but not equities.

Chadha (2016) suggested that, when a company is incorporated, the decision on capital structure has to be taken well in advance by analysing the pros and cons of the various sources of funds before choosing the best alternative that reduces the cost of capital [13]. An optimal capital structure will maximise the company's market value, thus planning on capital structure is a permanent progression and has to be decided whenever a firm needs extra funds. The common capital structures are equities and debts. If the company raises funds by issuing equity, equity holders are the owners of the company and they will have a long term interest with the company. In other words, if the aerospace company raises fund through equity, the shareholders will have trust in the company that it will expand in the near future. In contrast, if the fund is raised through debt, the creditors of the firm are the debt holders and they do not have long term interest with the firm as their concern is the received repayment on time. Therefore, the financial managers in the aerospace company play a crucial role in deciding the capital structure choice to ensure the firm grows well without facing illiquidity trap or bankruptcy fate.

From the summary of literature reviews, aerospace industry is influenced by internationalisation processes and international standards. The study on the operation and financial management on this industry is equally important to ensure its prosperous and sustainability in the global standard. It is found from the past literatures that capital raising through equity and debt would have different impact on the firm. Nevertheless, the issue on capital structure on aerospace industry is limited. Therefore, in this study, the highlighted contributions are to assess whether equity or debt fund raising is beneficial to the aerospace firms and to identify the cyclical loss of aerospace industry in order to warrant this industry on the financial indicator that will have an effect on its growth.

3. Data and methodology

The sample of the aerospace companies is chosen based on the Bloomberg Database classification as it is one of the most powerful platforms for financial professionals who require analytical data to make business decisions. In order to eliminate structural breaks due to economic crisis, the sample period chosen is from 2009 to the most recent available quarterly data which is 2015. The quarterly period is selected since most of the regulators require public listed companies to publish the quarterly report on quarterly basis. Only public listed aerospace companies are chosen since this study is focusing on the impact of equity and debt to the profitability of the firms. There are 47 aerospace companies in total to be studied in this research. Table 1 lists all of these companies.

The dependent variable is "net income", which is the company's total earnings captivating revenues and subtracting for cost of business, depreciation, other expenses, interest and taxes. The independant variables are total revenues, total liabilities and total equities. Definition of the independent variables and the expected results are presented in Table 2.

Due to different natures of aerospace companies, i.e. airlines, aircraft manufacturers, subsystems design companies, etc., the panel data model is used to control individual heterogeneity. Unobserved characteristics may vary across individuals (known as heterogeneity). If these influence the variables of interest and are correlated with unobserved explanatory variables, then estimated effects of these variables will be biased. Panel model uses differences with regards to the individual data average as solution: $y_{it} \rightarrow y_{it} - \bar{y}_{it}$ [14]. The panel data regression model will be employed to analyse the data as it consists of 47 aerospace companies. It has been suggested that this model is practical to control the individual heterogeneity (cross-section) and implications, which are difficult to be monitored through pre-cross sections or pure time series data [15]. To run the panel regression model, Stata Software is used. Based on the model suggested in [16] and [17], the estimated equation by taking the net income of the aerospace company as the profitability determinant is as shown in Equation 1.

$$NI_{it} = \beta_i + \beta_1 Rev_{it} + \beta_2 TL_{it} + \beta_3 TE_{it} + \varepsilon_i \quad (1)$$

Table 1. List of considered aerospace companies

NO	COMPANIES	COUNTRIES	NO	COMPANIES	COUNTRIES
1	BOMBARDIER INC-B	CANADA	24	MZ ARSENAL-$BRD	RUSSIA
2	CAE INC	CANADA	25	TECHPRIBOR-BRD	RUSSIA
3	MAGELLAN AEROSPA	CANADA	26	AS YAKOVLEV DESI	RUSSIA
4	HEROUX-DEVTEK IN	CANADA	27	DUKS-RTS BOARD $	RUSSIA
5	FLYHT AEROSPACE	CANADA	28	SATURN-BRD	RUSSIA
6	AVCORP IND INC	CANADA	29	MIL MOSCOW HELIC	RUSSIA
7	IWG TECHNOLOGIES	CANADA	30	SARAPUL ELEK-BRD	RUSSIA
8	STAR NAVIGATION	CANADA	31	SINGAP TECH ENG	SINGAPORE
9	AVIC AVIATION -A	CHINA	32	A-SONIC AERO	SINGAPORE
10	AVIC AIRCRAFT-A	CHINA	33	SAAB AB-B	SWEEDEN
11	AVIC AERO-ENGI-A	CHINA	34	CTT SYSTEMS AB	SWEEDEN
12	AVIC HELICOPTE-A	CHINA	35	UNITED TECH CORP	U.S.
13	CHINA AEROSPAC-A	CHINA	36	BOEING CO/THE	U.S.
14	JIANGXI HONGDU-A	CHINA	37	ESTERLINE TECH	U.S.
15	SICHUAN CHENGF-A	CHINA	38	TRIUMPH GROUP	U.S.
16	AIRBUS GROUP SE	FRANCE	39	RBC BEARINGS INC	U.S.
17	MTU AERO ENGINES	GERMANY	40	ASTRONICS CORP	U.S.
18	BET SHEMESH ENGI	ISRAEL	41	DUCOMMUN INC	U.S.
19	JAMCO CORP	JAPAN	42	LMI AEROSPACE	U.S.
20	SHOWA AIRCRAFT	JAPAN	43	SIFCO INDUSTRIES	U.S.
21	SUMITOMO PRECISI	JAPAN	44	INNOVATIVE SOL	U.S.
22	MACROASIA CORP	PHILIPINES	45	ASTROTECH CORP	U.S.
23	KUZNETSOV-BRD	RUSSIA	46	TEL-INSTRUM ELEC	U.S.
			47	MECHANICAL TECH	U.S.

Table 2. Definition of the variables and the expected results

Variables	Explanation	Expected Result	Rationale
Total Revenue (Rev)	Revenues from the sales of commercial airplanes such as Boeing and Airbus	Positive	The higher the sales, it will generate more profit to the company.
Total Liabilities (TL)	Short term and long term debt	Negative	The higher the liabilities, the more obligation of the firm on debt settlement, reduce the profit of the firm.
Total Equities (TE)	Shareholder equities in the stock market	Positive/ Negative	The more equities invested by the shareholder, signalling that they have confident on the firm to generate more profit in the future. The more equities holders, the firm will need to pay dividend to the shareholder and reduce net income; however dividend payment is at the discretion of the firm.

First of all, pooled ordinary linear regression model (Pooled OLS) is employed to demonstrate the result based on poolability of the data but the panel structure of the data is ignored. Next, the model to be executed is the random effect model (REM), which holds the constants for each section as random parameters. The third model is the fixed effect model (FEM) where the constants are taken as group specific, which means the model allows for different constants for each firm. The Breusch-Pagan Lagrangian Multiplier Test is done to select between pooled OLS and REM, where the null hypothesis refers to the preference of Pooled OLS versus alternative hypothesis that REM is preferred. Moreover, Hausman Test is executed to decide on the choice between REM and FEM, where the null hypothesis that refers to preference of REM versus alternative hypothesis that FEM is preferred. Examination for heterogeneity and serial correlation are also performed to check for robustness of the result.

4. Data analysis

Table 3 illustrates the descriptive statistic for the data. It is noticed that there was at least one company that had negative net income in a certain quarter and this company probably was unable to cover the cost of operating. Furthermore, the minimum total equity was negative, perhaps this company was in the ramp-up stage and had spent a large amount of funds to construct infrastructure that will later yield profits [18].

Table 3: Summary of descriptive data

Variables	Observation	Mean (USD)	Std Dev	Min (USD)	Max (USD)
NI	1316	68.5 mil	2.76e+8	-1.56 bil	3.28 bil
Rev	1316	1.31 bil	4.29e+9	0	25.8 bil
TL	1316	5.57 bil	1.94e+10	282,662	111 bil
TE	1316	1.39 bil	4.34e+09	-0.87 bil	35.5 bil

Figure 2 demonstrates the average net incomes, revenues, total liabilities and total equities for the aerospace companies. The trend of the average total liabilities is increasing, which indicates that the companies were increasingly borrowing more debts. The average net income was volatile. It is noticed that for each quarter one of the year, the average net income dropped compared to previous quarter. This may signal that the management needs to discover what had happened to the aerospace industry within the quarter one of the year.

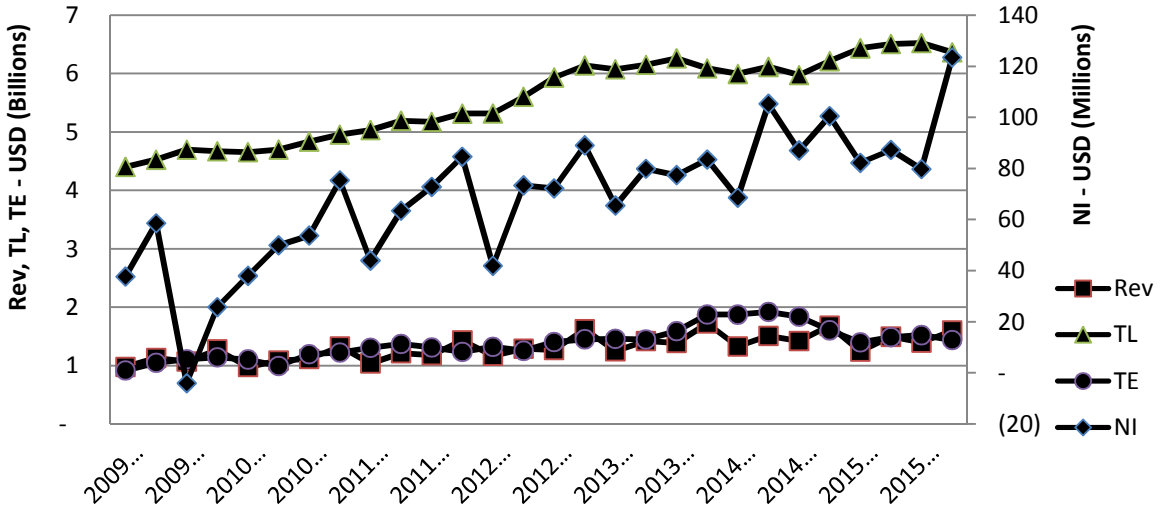


Figure 2. Average net incomes, revenues, total liabilities and total equities for aerospace companies

It is also realised that the average revenues and total equities were approximately similar. This might indicate that shareholders were willing to invest in the aerospace companies to the maximum of the revenues that the firm could earn. As the result, the firm has to opt for debt to raise further funds if there is a need for additional expansion in research and development. The higher portion of average total liabilities compared to average total equities is probably supported this likelihood.

The result in Table 4 is based on panel data model. The poolability test is used to investigate the feasibility of poolability among the independent variables in a panel although it is presumed that, in a panel, the character of heterogeneity will be controlled [19]. In model 1, two variables namely total revenues and total equities indicate positive significant impact to net income of aerospace companies. This means that the higher revenue of the firm can provide a better net profit to the firm. In addition, more capital is raised through equities will generate higher net income to the company. Conversely, total liabilities show negative significant impact to the net income, which suggests that the more debt that company hold, the income of the company will be impeded as more interest payments are obliged to be settled to the creditors. These result consistent with the recommendations in [13]. Model 2 is the robust Pooled OLS and it is executed to improve the existence of heterogeneity and autocorrelation in model 1. Similarly, total liabilities show a significant negative relationship to the net income. On the other hand, revenues and total equities indicate significant positive link to the net income. In model 3, it is assumed that the intercept is a random variable with the mean value for all sample companies. However, the result of Breusch Pagan LM Test does not reject null hypothesis and this indicates that pooled OLS is favorable than REM. Hausman test is carried out to measure the suitability between REM and FEM. The result rejects null hypothesis, which demonstrates that REM is not appropriate. In summary, model 2 is superior to the other three models as the diagnostic test Breusch-Pagan Lagrange Multiplier supported the hypothesis that pooled OLS is preferred and robust pooled OLS has corrected the heterogeneity and serial correlation issues.

Table 4. Results of the panel data

Independent Variables	**Pooled OLS**	**Pooled OLS (Robust)**	**REM**	**FEM**
Constant	-9619458** (3827255)	2.97e+7 (4.28e+7)	-9619458** (3827255)	-8.84e+7*** (7968695)
Rev	0.0821*** (0.0032)	0.0824*** (0.0086)	0.0821*** (0.0032)	0.0272*** (0.0051)
TL	-0.0119*** (0.0006)	-0.012*** (0.0012)	-0.0119*** (0.0006)	0.0226*** (0.0018)
TE	0.0269*** (0.0012)	0.0268*** (0.0047)	0.0269*** (0.0012)	-0.0034 (0.0033)
Observations	1316	1316	1316	1316
F-Test/Chi	4467.86***	8191000***	4467.86***	154.08***
Within	-	0.1031	0.0856	0.2675
R^2 Between	-	0.9875	0.9872	0.5854
Overall	0.773	0.7775	0.773	0.4866
B.P LM Test		1.89		
Hausman Test			446.97***	
Wald Test				2e+13***

Note: Figures in parentheses are standard errors.
*, **, *** indicate statistical significance at 10%, 5% and 1%, respectively

5. Conclusion

In this study, the impact of raising capital through total equities and total liabilities among aerospace companies is studied. The results show that raising fund by equities is favourable to the aerospace

company as the shareholders have trust on the companies to grow well in the future with the capital invested by them. This might also suggest that they prefer to enjoy capital appreciation rather more than regular dividend payment from the funds invested. On the contrary, raising funds by debts show negative impact to the net income of aerospace firms. This suggests that if the firms are unable to raise additional fund through equities, although they could opt for debt option, they need to be aware that the consequence is the erosion of net profit that might be suffering from the illiquidity or bankruptcy issue. In addition, the quarterly net income of aerospace companies is volatile and there is also a cyclical reducing trend in the average net income of the firms in the quarter one of the year. The limitation of this study is that it is unable to identify the cause of structural decreasing of net income in quarter one. Therefore, it is recommended that the future study could focus on this area to examine on other factors like aerospace technical issues, research and development, regulations issues or economic issues that cause the volatility of net income as well as the cyclical decrease in the net income.

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References
[1] Bjelicic B 2012 *Journal of Air Transport Managemen*t **21** 10-6
[2] Wojahn O W 2012 *Journal of Air Transport Management* **19** 1-8
[3] Koo R 2008 *The Holy Grail of Macroeconomics: Lessons from Japan's Great Recession* (Singapore: John Wiley & Sons)
[4] Pearce B 2012 *Journal of Air Transport Management* **21** 3-9
[5] Keuschnigg C and Ribi E 2013 *International Tax and Public Finance* **20** 808-26
[6] Aghion P, Fally T and Scarpetta S 2007 *Economic Policy* 731–79
[7] Tirole J 2001 *Econometrica* **69** 1–35
[8] Hubbard G R 1998 *Journal of Economic Literature* **36** 193–225
[9] Huettinger M 2013 *Baltic Journal of Management* **9** 71-90
[10] Lee J S and Jang S C S 2007 *Tourism Management* **28** 434-42
[11] Hung J H and Liu Y C 2005 *Journal of Air Transport Management* **11** 291-6
[12] Lee C H and Hooy C W 2012 *Journal of Air Transport Management* **24** 31-5
[13] Chadha S and Sharma A K 2016 *Global Business Review* **17** 411–24
[14] Law S H and Azman-Saini W N W 2012 *Economics of Governance* **13** 217–36
[15] Gujarati D N and Porter D C 2009 *Basic econometrics* (Boston: McGraw-Hill)
[16] Wang F S and Wu N H 2014 *2014 International Conference on Management Science & Engineering 21th Annual Conference Proceedings* 1393-9
[17] Margaritis D and Psillaki M 2010 *Journal of Banking & Finance* **34** 621-32
[18] Wensveen J G and Leick R 2009 *Journal of Air Transport Management* **15** 127-33
[19] Baltagi B H 2005 *Econometric Analysis of Panel Data* (Chichester: John Wiley & Sons Ltd)