

Executive summary

The report provides an analysis of Qantas and Virgin Australia to determine which one of them is a better long-term investment. The report comprises five parts: (1) the justification of why the two companies have been chosen; (2) SWOT analysis and growth rate estimation; (3) the financial ratio analysis; (4) stock market risk and return analysis; and (5) conclusions and recommendations. In part three, the Golden model and the method based on the ROE and the payout ratio are used to estimate growth rate. In part four, the standard deviation and the CAPM model are used to measure risk and return. The conclusion is that Qantas is a better investment. All the data used in this report are from DatAnalysis Premium via Morningstar (2019).

1. Identifying two publicly listed competing companies with their description.

The two companies compared in this assignment are Qantas Airways Limited (Qantas) and Virgin Australia Holdings Limited (Virgin). We choose these two companies for three reasons: (1) they are both listed on Australian Securities Exchange (ASX); (2) they conduct similar activities in the domestic and international airlines market; (3) intense and ongoing competition exists in between them.

Listing: Qantas and Virgin are listed on ASX. Their current trading information is as follows (ASX, 2019):

(AU\$)	Code	Market Cap	No. of shares	Daily Volume	Lowest price during 52 weeks	Highest price during 52 weeks
Qantas	QAN	8.54bn	1.6bn	12,495,631	5.18	6.92
Virgin	VAN	1.56bn	8.45bn	3,582,881	0.17	0.25

Activities: Qantas is the national carrier of Australia. Its revenue mostly comes from the transportation of passengers and freight to and from domestic and international destinations mainly under its brands of Qantas (its flagship), Jetstar (its low fare carrier) and Qantas Freight. It has an extensive domestic and international route network and a widely-covered network of its codeshare partners (IBISWorld, 2019a, p.6&19). Virgin began to operate in Australia under the brand of Virgin Blue Airlines in 2000. It focused on low-cost domestic flights at the beginning and received support from governments as incentives to service certain low-cost routes. Over, it has been developing to a full-service airline. It undertakes its domestic and international airline services under Virgin Australia and Tiger Airways (IBISWorld, 2019b, p.5&18).

Competition: Qantas and Virgin are the duopolies in the domestic airline market which occupy 60.4% and 30.0% of the market respectively (Youl, 2019b, p. 24). In international airlines market of Australia, Qantas and Virgin are the first and fifth largest players with the market share of 34.4% and 5.1% respectively (Youl, 2019a, p. 24). Their intense competition can be traced back to the establishment of Virgin Blue when its passenger numbers grew 300% during its first three years. In 2003, Qantas set up its low-cost subsidiary, Jetstar, to expand the low-cost airline market and to compete with Virgin (Zhang, Sampaio and Fu, 2016, p.

1&2). In the same year, after Virgin went public, it shifted its focus on high-value business travel market to compensate for the profit decline due to the competition from Qantas's low-cost subsidiary Jetstar. As Virgin continued to move to a full-service airline, it also acquired the low-cost airline Tiger Airways to boost its low-cost airline services. As for the regional market, Virgin took over SkyWest Airlines in April 2013 and, as a result, gained a substantial number of regional routes, which was also a move to compete with Qantaslink, the regional brand of Qantas (IBISWorld, 2019b, p. 18). In addition, according to the research of Zhang, Sampaio and Fu (2016), the fare changes of the duopoly rivals have been responded to that of each other in the previous period, and Qantas and Jetstar responded fiercer than Virgin and Tigerair.

2. Growth prospect

2.1. Industry Overview

The Australian aviation industry has grown at a fairly good rate overall in recent years. It is predicted that the growth will continue. The growth has mainly been driven by the traffic increase in the international flight segment as the domestic segment has demonstrated signs of saturation in recent years. The increase in the international market is due to the increasing number of people travelling to and from Australia over the past five years, especially the vigorous development of tourism. According to IBIS World, the International Airlines industry's revenue has grown at 3.0% yearly from 2014-2019 to total \$26.9 billion and will remain at 2.7% from 2019 to 2024. However, the fierce competition in this industry would depress the retail price of air tickets, and may weaken the growth rate of the industry in the future. In addition, the changes in interest rates and the unknown future of the value of Australian dollar are also potentially unstable factors for the development of Australian international aviation industry (Youl, 2019a).

2.2. SWOT analysis

The SWOT analysis of Qantas and Virgin is presented in the below table.

Among all the factors in the below table, two of them have drawn more attention.

The first is the fluctuations in fuel price. Changes in fuel price can significantly influence the industry's profits as fuel is one of the industry's largest costs. Among all operational costs in 2018, fuel costs account for 20.87% and 18.01% for Qantas and Virgin respectively. In 2012-2013, the fuel price over US\$100 per barrel had squeezed the industry's margin while in 2014-2015 the sharply reduced fuel price due to the global oversupply, along with the cost reduction initiative, had led to profit recovering. In 2019, the oil price is forecasted to increase (Youl, 2019b, p. 7). In February this year, mainly affected by the surge in oil price, Qantas has reported the lowest profit before tax since 2015 (Reuters, 2019).

The second is the changes in domestic demand. On 17 May, Virgin was reported that its half-year profit in February would fall back to loss due to the increased fuel price and the softening demand in both corporate

and leisure sectors weighted by decreased consumer spending and business confidence as economic growth had slowed down (Westbrook, 2019). For Qantas, though it experienced a slight revenue increase in the third quarter in 2018-2019 due to more leisure travel demand, it has reported weaknesses in domestic corporate market (Reuters, 2019).

	Qantas		Virgin	
Internal factors	<u>Strength</u>	<u>Weakness</u>	<u>Strength</u>	<u>Weakness</u>
Internal factors	<u>Strength</u> 1.Strong dominance in Australia market 2.Growing global presence through partnerships 3.Strong marketing and public relations 4.Dual brand strategy helping growth and market segmentation 5. Advanced technology usage	<u>Weakness</u> 1. Lowering the cost base will involve layoffs and tense industrial relations 2.Mismatch in capacity increase and market demand	<u>Strength</u> 1. Strong brand recognition 2. The full-service airline provides multiple choices for the passenger	<u>Weakness</u> 1. Virgin is not the biggest company in Australia airline industry 2. Virgin has not paid any dividend since 2008 3. unstable and declining share price
External factors	<u>Opportunity</u> 1.Opportunities in layoffs program and digital marketing 2. Leveraging big data analytics to improve operational efficiency and customer experience 3. High level of technology development to decrease costs 4. Eased price war		<u>Threat</u> 1. Regulatory issues hinder business expansion. 2. Increasing competition from Asian rivals 3. Increasing world oil prices 4. strict regulation environment 5. changes in domestic demand	

2.3. Growth rate

In this section, earnings per share (EPS) is used to calculate growth rate. To estimate growth rate in EPS, we look at the return on equity (ROE) and the payout ratios. Firms that have a lower payout ratio and a higher return on equity will have higher growth rates in EPS. The assumption of this method is that the ROE and payout ratio remain unchanged over time. The formula used for calculations is expressed as $g = (1 - \text{payout ratio}) \times \text{ROE}$. Using the formula, the result of the expected growth rate of QAN is 21.27% (see Appendix A). Assuming that QAN can maintain its current return on equity and payout ratio, its growth rate in 2019 is 21.27%. However, due to VAH's negative ROE, the method cannot be used to calculate its growth rate.

The advantage of this method is that it attributes growth to the endogenous factors, since it makes the growth rate associated with how much a firm reinvests for future growth and the quality of its reinvestment. If the historical growth rates, such as their arithmetic average or a geometric average, are used to estimate expected growth rate, growth is an exogenous variable that affects value but is separated from the operating details of the company (Damodaran, 2012). There are two main advantages of the method. The first is that with negative ROE it is hard to forecast the growth rate based on the formula. The second is that the main assumption of stable ROE and payout ratios. In fact, ROE is affected by the leverage decisions of the firm. Increasing leverage will lead to a higher ROE if the pre-interest, after-tax return on capital exceeds the after-tax interest

rate paid on debt. Therefore, this method ignores the changes in leverage and the consequent effects on growth (Damodaran, 2012).

For more accurate estimates, we looked into the historical EPS and DPS of QAN and VAH from their listed date (31/07/1995 for QAN and 08/12/2003 for VAN) (see Appendix B & C).

Mainly affected by the global financial crisis, QAN did not pay any dividend from 2009 to 2015 and VAH has not paid any dividend since 2008. As for EPS, Virgin has been in a loss state for a long time since GFC while QAN's EPS began to increase in 2015 after 6-year loss stated from 2009. From the historical data for the past decade (see Appendix B & C), Qantas seems to have recovered from the impact of the global financial crisis while Virgin still has negative profits. As a result, we estimate that Qantas will grow slightly in the coming year, while Virgin will hardly grow. The data in the following table are collected from DatAnalysis via Morningstar (2019). The analyst forecasts confirm our point of view.

		2019	2020	2021
QAN	EPS	57.2	59.5	54.6
	DPS	23.3	24.5	24
VAH	EPS	0.4	0.3	0.1
	DPS	0	0	0

Dividend growth rate has a close relationship with enterprise value. According to Gordon Model, Stock value = DPS /($r-g$) (where DPS represents the expected dividend for the next year, R represents the required stock return, and G represents the dividend growth rate). From the model, it can be seen that the higher the dividend growth rate, the higher the value of corporate stock. Obviously, QAN has a higher growth rate than VAH, so QAN's stock is more valuable.

3. Financial ratio analysis

3.1. Comparing financial ratios between QAN and VAH over the past five years

Liquidity ratio: Comparing the current ratio and quick ratio (appendix D) , Virgin has better short-term term repayment ability. Comparing the AR receivable ratio, Virgin's ratio has increased faster and it is higher which means that Virgin has a more frequent receivables “rolled over” in a year and shorter average receivable collection period. Virgin also has a better liquidity in inventory. Overall, Virgin has a better liquidity management.

Capital structure ratio: Qantas has a lower level of assets financed by its debt than the Virgin currently. Qantas has a much better interest repayment ability from 2015 to 2017 but significantly decreased in 2018 to a level lower than that of Virgin.

Asset management efficiency ratios: Comparing total asset turnover ratio, the difference in between has been minor over past five years which means that they have had the same efficiency in utilizing their total

assets to generate sales at present. Comparing the fixed asset turnover, Virgin has better efficiency in utilizing its fixed assets to generate sales at present.

Profitability ratio: Overall, Qantas has better profitability and control on costs than Virgin. In 2014 and 2018, Virgin's net profit margin is even negative. However, Virgin has a better control on the operating expenses, because the its profit only decreased about 6 percent from gross profit margin to operating profit margin while the profit decreased on Qantas is about 9 percent. ROA is equal to operating profit margin multiplied by total asset turnover. As the total asset turnover ratios of Qantas and Virgin have been almost the same, Qantas's much higher ROA is mainly due to its high operating profit margin. Among all the ratios, the largest difference exists in ROE with 47.64 for Qantas and -17 for Virgin in 2018. According to Dupont method analysis, ROE is equal to net profit margin multiplied by total asset turnover times equity multiplier which is the total assets divided by the ordinary equity (Titman et al.). As their total asset turnover ratios are almost the same, the differences of ROE are mainly because Qantas's higher net profit margin and higher equity multiplier. (see Appendix E).

Market value ratio: The PE ratio shows that investors are currently willing to pay more for Qantas's earnings per share. The market to book ratio demonstrates that Qantas has better market value on the accumulated investment in its equity.

3.2. Compared financial ratios between QAN and VAH in 2018

	QAN	VAH	COMMENT
Current ratio	0.49	0.78	QAN has less ability to pay back short-term loans.
Quick ratio	0.44	0.77	QAN has a high risk of short-term debt repayment.
Inventory turnover	39.31	102.09	QAN's inventory is less liquid than VAH.
Accounts receivable turnover	18.31	28.23	VAH has a better liquidity of its receivables
Debt Ratio	0.79	0.82	QAN has a lower level of assets financed by its debt.
Interest coverage ratio	0.52	1.47	QAN has weaker ability to pay interest in time.
Total asset turnover	0.89	0.88	Two companies have the same level of efficiency in utilizing their total assets.
Fixed asset turnover	1.29	1.79	QAN is less efficient in using fixed assets.
Gross profit margin	19.61	10.36	QAN has a greater probability and a better cost control.
Operating profit margin	10.42	4.13	QAN has a better control over operating expenses.
Net Profit Margin	6.86	-7.54	QAN has better control over interest expenses and tax revenue.

Return on Assets	9.29	3.62	QAN has a more efficient asset utilization, a better profitability, and a higher management level.
Return on Equity	47.64	-17	QAN's shareholders receive a higher return on equity.
Price-earnings ratio	9.49	-4.55	Investors are willing to pay more for QAN.
Market-to-book ratio	2.62	1.70	The market is valuing VAH's equity cheaply compared to its book value

3.3. Strengths and weaknesses of the ratio analysis on these two companies

Strengths: Some financial ratios are very useful when analyzing airline companies, such as the quick ratio. This is because the airline industry is capital-intensive with huge debts and the quick ratio can measure the ability of company to pay for its debt easily. Furthermore, using the analysis, the companies' financial statements can be standardized and therefore comparable. These financial ratios can also provide an efficient overview of company's financial performance.

Weaknesses: It is very difficult to find an appropriate benchmark of the industry ratio for each company to compare since there are only five companies in the Australian domestic airline industry. Moreover, financial ratios only represent some clues rather than reflect the amount special information. For example, the intense price war between the two companies in 2014 which deteriorated their financial ratios are not directly reflected in those figures. Further, in-depth analysis is needed after financial ratio analysis conducted.

4. Return and risk

In this section, data used to compute the expected return, the standard deviation and β are the five years' data of the monthly share prices of both QAN and VAH, the yields on 5-year treasury bond and the market return from 1st July 2013 to 31st June 2018 (see Appendix F).

4.1. Expected return and standard deviation

Expected return is what investors expect to earn from an investment in the future. The standard deviation and the variance of the rate of return reflect the total risk of an investment.

The method used is the mean-variance approach. The formula of $r_t = \frac{(P_t - P_{t-1}) + D_i v_t}{P_{t-1}}$ is used to calculate the rate of return. r_t is the rate of return in period t, P_t is the adjusted closing price in period t, P_{t-1} is the adjusted closing price in period t-1 and $D_i v_t$ is the dividend in period t. The arithmetic average used to compute the monthly expected return is $E(r) = \bar{r} = \frac{1}{n} \sum_{t=1}^n r_t$. The formula used to compute the monthly

standard deviation is $\sigma = \sqrt{\frac{\sum_{t=1}^n (r_t - \bar{r})^2}{n-1}}$. Based on the calculation in Appendix F, the results of r and σ of QAN,

VAH, ASX and 5-year Treasury bond are as follows:

	QAN	VAH	ASX	5-year T-bond
Monthly expected return	0.0333	-0.0038	0.0039	0.0020
Monthly standard deviation	0.0947	0.1106	0.0319	0.0004

According to the result, the monthly expected return of QAN is higher than that of VAH which is negative. It means that investors expect revenue from QAN whereas loss from VAH. Monthly standard deviation of QAN is lower than that of VAH. It represents that QAN has lower volatility around its expected return than VAH and QAN's total risk (systematic/market and unsystematic) is lower than that of VAH. Therefore, QAN with a higher expected return and lower total risks is a better investment compared to VAN.

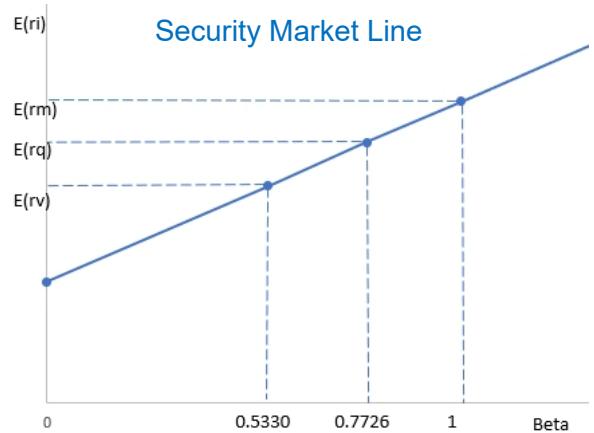
4.2. Beta

The CAPM states the expected return on any investment is the total of the risk-free rate of return and a risk premium which is the market risk (systematic risk) attributable to the investment, the quantity of which is given by beta. The relationship can be represented by the function of $E(r_i) = r_f + \beta_{i,m} \times E(r_m - r_f)$

The beta can be calculated by using the function of $\beta_{i,m} = \frac{E(r_i) - r_f}{E(r_m - r_f)} = \frac{\sigma_{i,m}}{\sigma_m^2}$. In this function, $E(r_i)$ is the expected return on the portfolio and security i. r_f is the risk-free rate of return which can be represented by the rate of return of the 5-year treasury bond. $E(r_m)$ is the expected return of the market. $\sigma_{i,m}$ is the covariance of excess returns on the stock and market. σ_m^2 is the variance of excess returns on the market. According to the calculation in Appendix G, β QAN is 0.7726 and β VAN is 0.5330.

The function of $E(r_i - r_f) = \beta_{i,m} \times E(r_m - r_f)$, transformed from $E(r_i) = r_f + \beta_{i,m} \times E(r_m - r_f)$, can be graphically represented as a security characteristic line, which is the time-series regression result of data. The slope of the line is beta. According to Appendix G, the beta of QAN is 0.7726 which means that if the market price increases 1%, the price of stock QAN also increases by 0.7726% while the beta of VAH is 0.5329 which means if the market price increases 1%, the price of stock QAN also increases by 0.7726%. Therefore, the share price of QAN is more susceptible to the market fluctuations than that of VAH, which means QAN's stock has more systematic risks than VAN.

From another aspect, according to the equation of $E(r_i) = r_f + \beta_{i,m} \times E(r_m - r_f)$, once the expected market return and the risk-free rate is estimated, beta is the sole factor to explains the stock returns and the relationship can be potted as security market line. The positive relationship means that QAN's stock with higher beta has higher expected return, which is consistent with the result of the expected return in section 4.1 and the risk-return trade off principle.



There are several advantages of the CAPM model we used. Firstly, as beta is the sole factor determining the expected return, investors could use it to compare their investments directly and require a higher return with a higher beta. Then it only considered systematic risk in line with the fact that most investors have a diversified portfolio which has eliminated the unsystematic risk (ACCA, n.d.).

However, the model we used is only the basic form. Disadvantages of the basic model is that it is based on an idealized market with several assumptions: (1) investors are risk-adverse expecting highest return with the lowest risk over the same holding period; (2) capital market is perfect, that is, for example, all borrowing and lending can be conducted at the risk-free rate and information is complete and rationally processed; (3) the same investment opportunities are available to all the investors; and (4) all investors have the same estimation on $E(r_i)$ and σ_i . To address this issue, many developed models are to accommodate complex situations in reality (Perold, 2004, p.15-16). In this section, all calculations are purely based on historical data making the beta derived conditional on historical situations, and therefore any future uncertainties will impact the result.

5. Conclusion and recommendation

Qantas and Virgin as duopolies in the Australian airline industry are susceptible to and representative of all changes in the industry. Even though the industry's revenue is forecasted to increase, the increasing oil prices have pressured their profitability. For Qantas, part of the pressure could be eased by its large market share and its growth in the international market (Reuters, 2019). However, for Virgin, apart from the increase in fuel price, softening domestic demand could further impair its profitability. As for growth rate, assuming that Qantas's current ROE and payout ratio maintains, its growth rate in earnings per share would be 21.27%. However, Virgin has a negative ROE with no dividend payment since 2009, and analysts forecast that Virgin's EPS will fluctuate around zero for the following five years. According to the Golden model, Qantas will also have a higher growth rate. Based on the analysis of financial ratios, all profitability ratios indicate that Qantas is much more profitable than Virgin. The PE ratio and the market-to-book ratio also reveal that investors are much more optimistic about Qantas. Based on our risk and return analysis, the shares of Qantas have lower total risks and higher return compared to Virgin. Further, the beta shows that when the market return and the risk-free return estimated, Qantas with a higher beta has a higher return. However, it is also more sensitive to market risk. In conclusion, considering the economic conditions, growth rate, profitability and return and risk on shares, Qantas is investment.

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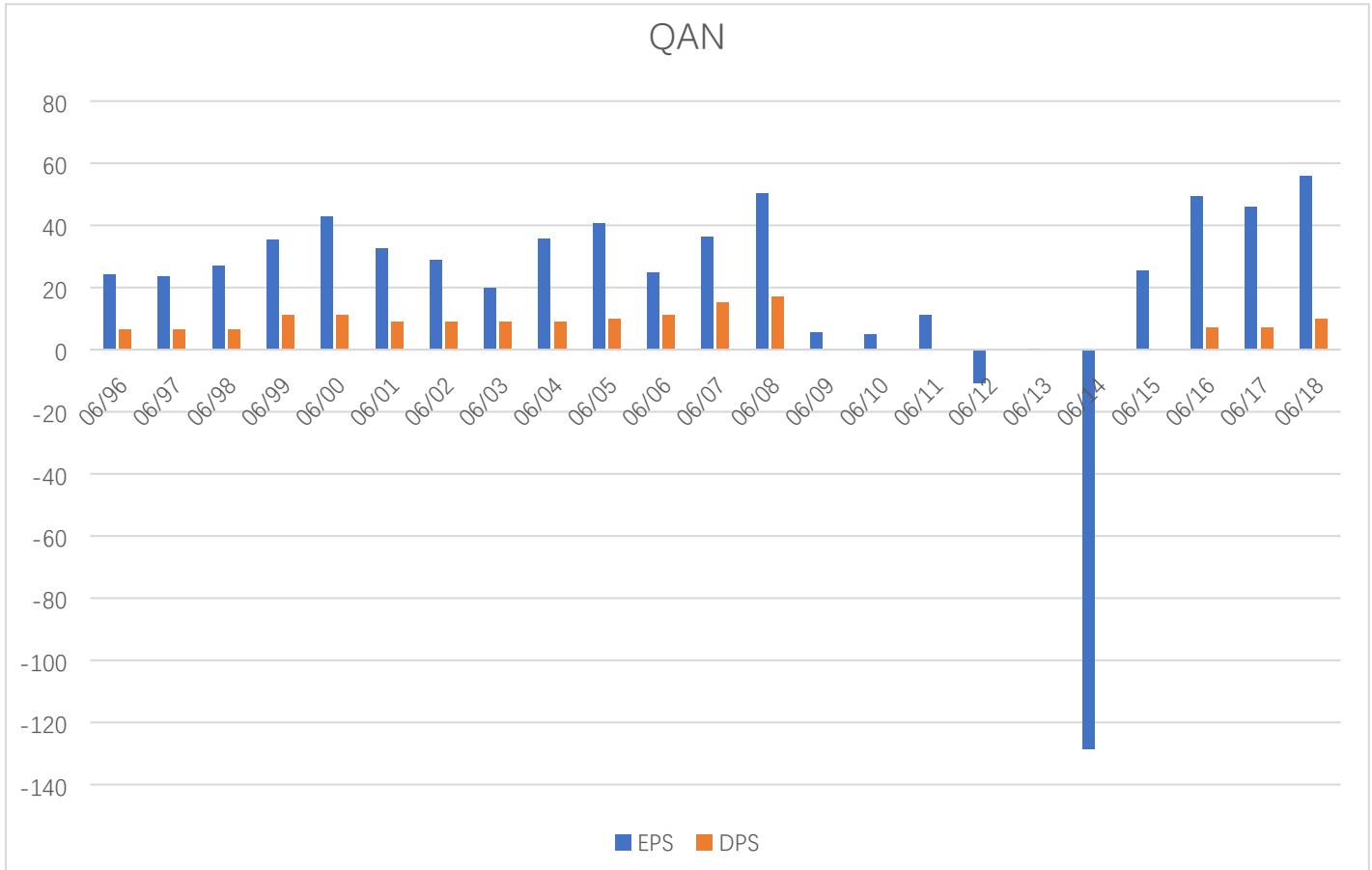
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Appendix

Appendix A: Fundamental Growth Rates in Earnings per Share

	Return on Equity	Payout Ratio	Expected Growth Rate
QAN	28.82%	26.19%	21.27%
VAH	-37.41%	--	--

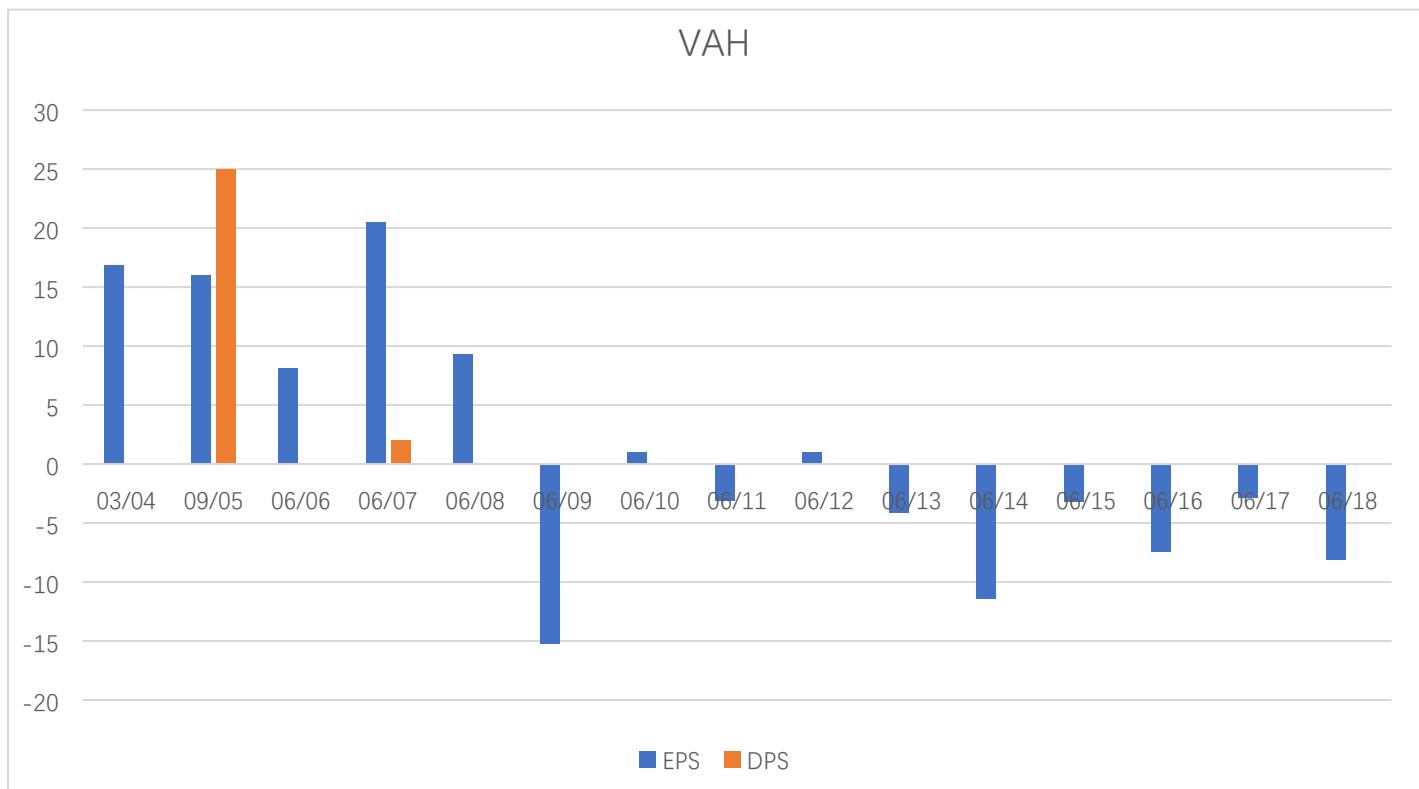
Appendix B: EPS and DPS of Qantas since 1996



QAN's data for the past decade

	06/09	06/10	06/11	06/12	06/13	06/14	06/15	06/16	06/17	06/18
EPS	5.6	4.9	11	-10.8	0.221	-128.5	25.4	49.4	46	56
DPS	0	0	0	0	0	0	0	7	7	10
EPS growth (%)		-12.5	124.4898	-198.182	-102.046	-58244.8	-119.767	94.48819	-6.88259	21.73913
DPS growth (%)	--	--	--	--	--	--	--	--	0	42.85714

Appendix C: EPS and DPS of Virgin since 2004



VAH's data for the past decade

	06/09	06/10	06/11	06/12	06/13	06/14	06/15	06/16	06/17	06/18
EPS	-15.2	1	-3.1	1	-4.1	-11.4	-3.2	-7.4	-2.8	-8.1
DPS	0	0	0	0	0	0	0	0	0	0
EPS growth (%)		106.5789	-410	132.2581	-510	-178.0487805	71.92982	-131.25	62.16216	-189.286
DPS growth (%)	--	--	--	--	--	--	--	--	--	--

Appendix D

	2014	2015	2016	2017	2018
Current ratio= Current Assets/Current Liabilities	QAN 0.66	0.68	0.49	0.44	0.49
	VAH 0.64	0.69	0.62	0.76	0.78
Quick ratio=Current Assets - Inventory /Current liabilities	QAN 0.61	0.63	0.44	0.39	0.44
	VAH 0.62	0.67	0.60	0.74	0.77
Inventory turnover= COGS/inventory	QAN 45.34	42.00	38.93	37.42	39.31
	VAH 114.80	107.78	107.03	99.83	102.09
Accounts receivable turnover ratio	QAN 12.67	16.20	19.85	20.00	18.31
	VAH 15.92	20.23	21.52	22.85	28.23
Debt Ratio= Total liabilities/Total assets	QAN 0.83	0.80	0.80	0.79	0.79
	VAH 0.78	0.82	0.85	0.75	0.82
Interest coverage ratio= EBIT/ Interest expense	QAN -2.17	4.61	8.65	7.90	0.52
	VAH -0.99	0.47	1.25	0.69	1.47
Total asset turnover= Sales/Total assets	QAN 0.88	0.89	0.94	0.91	0.89
	VAH 0.77	0.81	0.83	0.79	0.88
Fixed asset turnover= Sales/ (Net PPE)	QAN 1.44	1.45	1.35	1.28	1.29
	VAH 1.33	1.53	1.74	1.73	1.79
Gross profit margin= Gross profit/Sales	QAN 6.47	14.75	19.75	18.69	19.61
	VAH 4.51	6.79	9.90	8.44	10.36
Operating profit margin= EBIT/Sales	QAN -2.92	7.69	12.00	9.88	10.42
	VAH -2.92	0.94	4.24	2.29	4.13

Net Profit Margin= Net profit/Sales	QAN	3.21	4.53	8.11	6.53	6.86
	VAH	-2.31	0.07	4.16	0.34	-7.54
ROA (Return on Assets) = EBIT/Total assets	QAN	-2.55	6.82	11.34	8.99	9.29
	VAH	-2.55	0.76	3.50	1.82	3.62
ROE (Return on Equity) =Net profit/Ordinary equity	QAN	10.55	15.29	35.8	33.57	47.64
Price-earnings ratio= Share Price/EPS	VAH	-7.25	1.77	18.61	2.3	-17
Market-to-book ratio= MV per share/BV per share	QAN	5.72	9.86	4.59	10.35	9.49
	VAH	-16.04	430.00	3.49	76.19	-4.55
	QAN	0.96	2.01	1.65	2.83	2.62
	VAH	1.44	1.48	0.92	0.86	1.70

Appendix E: Equity multiplier of Qantas and Virgin

	2014	2015	2016	2017	2018
Qantas	3.75	3.79	4.67	5.64	7.79
Virgin Australia	4.08	5.01	4.61	2.83	2.76

Appendix F: Calculations of expected return, standard deviation and beta

ASX200

Date	Adjusted Close price	r m: rate of monthly return
2013/7/31	5135.0000	
2013/8/31	5218.8999	0.0163
2013/9/30	5425.5000	0.0396
2013/10/31	5320.1001	-0.0194
2013/11/30	5352.2002	0.0060
2013/12/31	5190.0000	-0.0303
2014/1/31	5404.7998	0.0414
2014/2/28	5394.7998	-0.0019
2014/3/31	5489.1001	0.0175
2014/4/30	5492.5000	0.0006
2014/5/31	5395.7002	-0.0176
2014/6/30	5632.8999	0.0440
2014/7/31	5625.8999	-0.0012
2014/8/31	5292.7998	-0.0592
2014/9/30	5526.6001	0.0442
2014/10/31	5313.0000	-0.0386
2014/11/30	5411.0000	0.0184
2014/12/31	5588.2998	0.0328
2015/1/31	5928.7998	0.0609
2015/2/28	5891.5000	-0.0063
2015/3/31	5790.0000	-0.0172
2015/4/30	5777.2002	-0.0022
2015/5/31	5459.0000	-0.0551
2015/6/30	5699.2002	0.0440
2015/7/31	5207.0000	-0.0864
2015/8/31	5021.6001	-0.0356
2015/9/30	5239.3999	0.0434
2015/10/31	5166.5000	-0.0139
2015/11/30	5295.8999	0.0250
2015/12/31	5005.5000	-0.0548
2016/1/31	4880.8999	-0.0249

5-year Bond

Date	yield(p.a.)	r f: rate of monthly return
2013/7/31	0.02913	0.0024
2013/8/31	0.03108	0.0026
2013/9/30	0.03253	0.0027
2013/10/31	0.03421	0.0029
2013/11/30	0.03522	0.0029
2013/12/31	0.03474	0.0029
2014/1/31	0.03352	0.0028
2014/2/28	0.03313	0.0028
2014/3/31	0.03458	0.0029
2014/4/30	0.03331	0.0028
2014/5/31	0.03121	0.0026
2014/6/30	0.02965	0.0025
2014/7/31	0.02977	0.0025
2014/8/31	0.02844	0.0024
2014/9/30	0.03016	0.0025
2014/10/31	0.02835	0.0024
2014/11/30	0.0259	0.0022
2014/12/31	0.02329	0.0019
2015/1/31	0.02089	0.0017
2015/2/28	0.01979	0.0016
2015/3/31	0.01861	0.0016
2015/4/30	0.02127	0.0018
2015/5/31	0.0212	0.0018
2015/6/30	0.02405	0.0020
2015/7/31	0.022	0.0018
2015/8/31	0.0208	0.0017
2015/9/30	0.02105	0.0018
2015/10/31	0.02093	0.0017
2015/11/30	0.0231	0.0019
2015/12/31	0.02314	0.0019
2016/1/31	0.02167	0.0018

2016/2/29	5082.7998	0.0414
2016/3/31	5252.2002	0.0333
2016/4/30	5378.6001	0.0241
2016/5/31	5233.3999	-0.0270
2016/6/30	5562.2998	0.0628
2016/7/31	5433.0000	-0.0232
2016/8/31	5435.8999	0.0005
2016/9/30	5317.7002	-0.0217
2016/10/31	5440.5000	0.0231
2016/11/30	5665.7998	0.0414
2016/12/31	5620.8999	-0.0079
2017/1/31	5712.2002	0.0162
2017/2/28	5864.8999	0.0267
2017/3/31	5924.1001	0.0101
2017/4/30	5724.6001	-0.0337
2017/5/31	5721.5000	-0.0005
2017/6/30	5720.6001	-0.0002
2017/7/31	5714.5000	-0.0011
2017/8/31	5681.6001	-0.0058
2017/9/30	5909.0000	0.0400
2017/10/31	5969.8999	0.0103
2017/11/30	6065.1001	0.0159
2017/12/31	6037.7002	-0.0045
2018/1/31	6016.0000	-0.0036
2018/2/28	5759.3999	-0.0427
2018/3/31	5982.7002	0.0388
2018/4/30	6011.8999	0.0049
2018/5/31	6194.6001	0.0304
2018/6/30	6280.2002	0.0138
excepted return(monthly)		0.0039
standard deviation(monthly)		0.0319

2016/2/29	0.01963	0.0016
2016/3/31	0.02098	0.0017
2016/4/30	0.02064	0.0017
2016/5/31	0.01847	0.0015
2016/6/30	0.01676	0.0014
2016/7/31	0.01554	0.0013
2016/8/31	0.0163	0.0014
2016/9/30	0.01699	0.0014
2016/10/31	0.01973	0.0016
2016/11/30	0.02273	0.0019
2016/12/31	0.0233	0.0019
2017/1/31	0.02253	0.0019
2017/2/28	0.02266	0.0019
2017/3/31	0.02266	0.0019
2017/4/30	0.02126	0.0018
2017/5/31	0.01923	0.0016
2017/6/30	0.0219	0.0018
2017/7/31	0.02187	0.0018
2017/8/31	0.02241	0.0019
2017/9/30	0.0237	0.0020
2017/10/31	0.02201	0.0018
2017/11/30	0.02146	0.0018
2017/12/31	0.02353	0.0020
2018/1/31	0.02413	0.0020
2018/2/28	0.02373	0.0020
2018/3/31	0.02319	0.0019
2018/4/30	0.02436	0.0020
2018/5/31	0.02315	0.0019
2018/6/30	0.0228	0.0019
excepted return(monthly)		0.0020

QANTAS

Date	Adjusted Close price	Divq	r q: rate of monthly return	X:(rm-rf): excess market return	Y:(rq-rf): excess stock return
2013/7/31	1.3183				
2013/8/31	1.4194		0.0766	0.0137	0.0741
2013/9/30	1.1980		-0.1559	0.0369	-0.1586
2013/10/31	1.1740		-0.0201	-0.0223	-0.0229
2013/11/30	1.0537		-0.1025	0.0031	-0.1054
2013/12/31	1.0585		0.0046	-0.0332	0.0017
2014/1/31	1.1211		0.0591	0.0386	0.0563
2014/2/28	1.0633		-0.0515	-0.0046	-0.0543
2014/3/31	1.1740		0.1041	0.0146	0.1012
2014/4/30	1.3520		0.1516	-0.0022	0.1489
2014/5/31	1.2125		-0.1032	-0.0202	-0.1058
2014/6/30	1.2847		0.0595	0.0415	0.0571
2014/7/31	1.4146		0.1011	-0.0037	0.0986
2014/8/31	1.3376		-0.0544	-0.0616	-0.0568
2014/9/30	1.6166		0.2086	0.0417	0.2061
2014/10/31	1.8476		0.1429	-0.0410	0.1405
2014/11/30	2.3095		0.2500	0.0163	0.2478
2014/12/31	2.5116		0.0875	0.0308	0.0856
2015/1/31	2.7810		0.1073	0.0592	0.1055
2015/2/28	3.0023		0.0796	-0.0079	0.0779
2015/3/31	3.2621		0.0865	-0.0188	0.0850
2015/4/30	3.3872		0.0383	-0.0040	0.0366
2015/5/31	3.0408		-0.1023	-0.0568	-0.1040
2015/6/30	3.6086		0.1867	0.0420	0.1847
2015/7/31	3.2333		-0.1040	-0.0882	-0.1058
2015/8/31	3.5797		0.1071	-0.0373	0.1054
2015/9/30	3.5692		-0.0029	0.0416	-0.0047
2015/10/31	3.2891		-0.0785	-0.0157	-0.0802
2015/11/30	3.6957		0.1236	0.0231	0.1217
2015/12/31	3.5059		-0.0513	-0.0568	-0.0533
2016/1/31	3.4878		-0.0052	-0.0267	-0.0070

VIRGIN

Date	Adjusted Close price	r v: rate of monthly return	X:(m-rf): excess market return	Y:(rv-rf): excess stock return
2013/7/31	0.3837			
2013/8/31	0.4230	0.1026	0.0137	0.1000
2013/9/30	0.4083	-0.0349	0.0369	-0.0376
2013/10/31	0.3900	-0.0448	-0.0223	-0.0476
2013/11/30	0.3800	-0.0256	0.0031	-0.0286
2013/12/31	0.3450	-0.0921	-0.0332	-0.0950
2014/1/31	0.3500	0.0145	0.0386	0.0117
2014/2/28	0.3700	0.0571	-0.0046	0.0544
2014/3/31	0.3700	0.0000	0.0146	-0.0029
2014/4/30	0.4100	0.1081	-0.0022	0.1053
2014/5/31	0.4300	0.0488	-0.0202	0.0462
2014/6/30	0.4050	-0.0581	0.0415	-0.0606
2014/7/31	0.4150	0.0247	-0.0037	0.0222
2014/8/31	0.3800	-0.0843	-0.0616	-0.0867
2014/9/30	0.3850	0.0132	0.0417	0.0106
2014/10/31	0.4150	0.0779	-0.0410	0.0756
2014/11/30	0.4200	0.0120	0.0163	0.0099
2014/12/31	0.4700	0.1190	0.0308	0.1171
2015/1/31	0.5000	0.0638	0.0592	0.0621
2015/2/28	0.5150	0.0300	-0.0079	0.0284
2015/3/31	0.5100	-0.0097	-0.0188	-0.0113
2015/4/30	0.4700	-0.0784	-0.0040	-0.0802
2015/5/31	0.4300	-0.0851	-0.0568	-0.0869
2015/6/30	0.4400	0.0233	0.0420	0.0213
2015/7/31	0.4650	0.0568	-0.0882	0.0550
2015/8/31	0.4850	0.0430	-0.0373	0.0413
2015/9/30	0.4800	-0.0103	0.0416	-0.0121
2015/10/31	0.4350	-0.0938	-0.0157	-0.0955
2015/11/30	0.4550	0.0460	0.0231	0.0441
2015/12/31	0.4900	0.0769	-0.0568	0.0750
2016/1/31	0.4450	-0.0918	-0.0267	-0.0936

2016/2/29	3.6776		0.0544	0.0397	0.0528
2016/3/31	2.9095	0.07	-0.1898	0.0316	-0.1916
2016/4/30	2.7830		-0.0435	0.0223	-0.0452
2016/5/31	2.5481		-0.0844	-0.0285	-0.0860
2016/6/30	2.8553		0.1206	0.0614	0.1192
2016/7/31	2.9276		0.0253	-0.0245	0.0240
2016/8/31	2.8192		-0.0370	-0.0008	-0.0384
2016/9/30	2.8233	0.07	0.0263	-0.0232	0.0249
2016/10/31	3.0447		0.0784	0.0214	0.0768
2016/11/30	3.0724		0.0091	0.0395	0.0072
2016/12/31	3.1462		0.0240	-0.0099	0.0221
2017/1/31	3.4599		0.0997	0.0144	0.0978
2017/2/28	3.5891		0.0373	0.0248	0.0354
2017/3/31	3.9864	0.07	0.1302	0.0082	0.1283
2017/4/30	4.7103		0.1816	-0.0354	0.1798
2017/5/31	5.3779		0.1417	-0.0021	0.1401
2017/6/30	5.0018		-0.0699	-0.0020	-0.0718
2017/7/31	5.3779		0.0752	-0.0029	0.0734
2017/8/31	5.4813		0.0192	-0.0076	0.0174
2017/9/30	5.8547	0.07	0.0809	0.0380	0.0789
2017/10/31	5.3977		-0.0780	0.0085	-0.0799
2017/11/30	4.7980		-0.1111	0.0142	-0.1129
2017/12/31	5.0169		0.0456	-0.0065	0.0437
2018/1/31	5.6072		0.1176	-0.0056	0.1156
2018/2/28	5.5501		-0.0102	-0.0446	-0.0122
2018/3/31	5.5590	0.07	0.0142	0.0368	0.0123
2018/4/30	6.1178		0.1005	0.0029	0.0985
2018/5/31	5.9347		-0.0299	0.0285	-0.0319
2018/6/30	6.4743		0.0909	0.0119	0.0890
excepted return(monthly)	0.0333	σ_{qm}		0.0008	
standard deviation(monthly)	0.0947	$\sigma^2 m$		0.0010	
		β_{qm}		0.7726	

2016/2/29	0.3650	-0.1798	0.0397	-0.1814
2016/3/31	0.3500	-0.0411	0.0316	-0.0428
2016/4/30	0.3000	-0.1429	0.0223	-0.1446
2016/5/31	0.2050	-0.3167	-0.0285	-0.3182
2016/6/30	0.2400	0.1707	0.0614	0.1693
2016/7/31	0.2300	-0.0417	-0.0245	-0.0430
2016/8/31	0.2350	0.0217	-0.0008	0.0204
2016/9/30	0.2350	0.0000	-0.0232	-0.0014
2016/10/31	0.2200	-0.0638	0.0214	-0.0655
2016/11/30	0.2350	0.0682	0.0395	0.0663
2016/12/31	0.2200	-0.0638	-0.0099	-0.0658
2017/1/31	0.1900	-0.1364	0.0144	-0.1382
2017/2/28	0.1900	0.0000	0.0248	-0.0019
2017/3/31	0.1850	-0.0263	0.0082	-0.0282
2017/4/30	0.1700	-0.0811	-0.0354	-0.0829
2017/5/31	0.1600	-0.0588	-0.0021	-0.0604
2017/6/30	0.1750	0.0937	-0.0020	0.0919
2017/7/31	0.1850	0.0571	-0.0029	0.0553
2017/8/31	0.1850	0.0000	-0.0076	-0.0019
2017/9/30	0.1850	0.0000	0.0380	-0.0020
2017/10/31	0.2900	0.5676	0.0085	0.5657
2017/11/30	0.2800	-0.0345	0.0142	-0.0363
2017/12/31	0.2700	-0.0357	-0.0065	-0.0377
2018/1/31	0.2500	-0.0741	-0.0056	-0.0761
2018/2/28	0.2200	-0.1200	-0.0446	-0.1220
2018/3/31	0.2200	0.0000	0.0368	-0.0019
2018/4/30	0.2300	0.0455	0.0029	0.0434
2018/5/31	0.2200	-0.0435	0.0285	-0.0454
2018/6/30	0.2200	0.0000	0.0119	-0.0019
excepted return(monthly)	-0.0038	σ_{vm}	0.0005	
standard deviation(monthly)	0.1106	$\sigma^2 m$	0.0010	
		β_{vm}		0.5330

Appendix G: Beta regression

