Инструменты улучшения финансового здоровья глобальных авиакомпаний

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Аннотация

В период мировой экономической нестабильности необходим систематизированный подход к определению и оценке факторов, влияющих на финансовое состояние наиболее уязвимых отраслей и компаний. В данной статье исследуется влияние факторов на авиакомпании. На примере выборки из 39 мировых авиакомпаний, произведена оценка влияния факторов на их финансовое состояние. На основе данной оценки факторов, разработаны рекомендации для улучшения финансового состояния компаний, которые все еще борются с ковидными ограничениями.

Ключевые слова: Оценка авиакомпаний, мировой рынок авиаперевозок, оценка факторов, улучшение финансового состояния авиакомпаний.

Tools for improving financial health of global airlines

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Abstract

In times of economic recession, a systematic and scientific approach is needed to identify and value the factors affecting the financial health of the most vulnerable industries and companies. This article examines the impact of factors on global airline market. Using a sample of 39 global airlines, we assessed the impact of factors on their financial health. Based on this assessment of the factors, we developed recommendations to improve the financial health of companies that are still struggling with covid constraints.

Keywords: Airline company valuation, global airline market, financial health factors, financial-health improvement.

The relevance of the topic of this research is evidenced from the fact that airlines' leadership teams will still have to implement corrective measures for the regions with continuing covid restrictions to mitigate the effect of pandemic, to reassess the needs in external support and to articulate strategic priorities to prepare for the future potential economic disruptions. The research will show which factors were more and which were less impactful based on a sample of 39 airlines and will present methodology for implementing these measures.

Across diverse industries, the management teams applied responsive measures during pandemic. These measures were aimed at customer experience, redesigning supply chains, establishing remote work practices, strategic refocus, strong cost cutting, acquiring additional finance from banks and equity holders and deferring capital expenditures. Also, there was significant external support aimed at stabilizing companies' economics – subsidizing, tax holidays, low-interest borrowings. Besides, we would like to emphasize that the companies entered the pandemic world having different scores of financial health (i.e. profitability, capital efficiency, solvency and liquidity), therefore each company had different endowment which could itself improve or aggravate their financial well-being. In the current graduation work, we will focus on three groups of factors which contributed financial responsiveness of the airlines around the world during pandemic:

- Endowment factors – in what state the company faced the pandemic;
- External factors – what governments, society and organizations did to sustain airline companies' performance during the pandemic;
- Internal factors – what the airline company did itself to sustain its performance during the pandemic.

The purpose of the research is to determine and assess the factors which would enable to obtain stronger financial health to the airlines that are still challenged by the pandemic restrictions.

Airline services market represents a subset of transportation sector, it is one of the markets within global aviation industry. Aviation industry comprises several markets, whose players are airlines, aircraft manufacturing companies, lessors, MRO (Maintenance, Repair and Overhaul) operators, airports, travel agencies, forwarders, and other companies.

In the current research, we are scrutinizing airline services global market. We regard only airlines which have annual cargo revenue less than 35% of the total annual revenue. Otherwise, these airlines could be classified as freight carriers, and would dilute the results of research due to significantly different value chains. Despite airlines are most recognized companies associated with aviation in the world, they generate least economic profit.

Traffic revenue is usually generated from passenger and cargo flights. Passenger services are divided into full-service, low-cost and luxury segments, with respective ticket price differentiation. Ancillary services include booking, seat selection and baggage fees, airport VIP lounges, taxi transfers, goods sold aboard and may other services. Normally, they represent 5-10% of traffic revenue for a full-service or luxury airline and 25-35% for a low-cost airline.

Typical EBITDA (Earnings before Interest, Taxes, Depreciation and Amortization) margin for airline carriers before the pandemic was 22-25%, in 2020 it amounted to LBITDA (Loss Before Interest, Taxes, Depreciation and Amortization) margin of 8-11% on average.

During COVID-19 pandemic, three-fourths of global international flight network were suspended, about 70% of the global fleet was grounded and unused for 4 to 7 months during 2020, 18 airlines have filed for bankruptcy in a matter of months. According to estimates of McKinsey & Company, $315 billion is lost in passenger revenue segment in 2020.[1]

Industry-average ROIC (Return on Invested Capital) sank from 5.8 to -17.7% in 2020. Airlines operating in North America suffered most: their average ROIC decreased 2.6 times from 2019 (Refer to Table 1).

Table 1. Extract from IATA report, financial indicators, September 2020[2]

Worldwide airline industry	**2019**	**2020F**	**2021F**
Industry ROIC, % Invested capital	5.8%	-17.7%	-6.8%
North America	9.9%	-15.8%	-4.0%
Europe	7.0%	-18.0%	-7.5%
Asia Pasific	3.5%	-6.7%	-2.7%
Latin America	3.9%	-16.4%	-14.0%

[1] Seth Borko, Wouter Geerts and Haixia Wang. Article "The travel industry turned upside down. Insights analysis and actions for travel executives", September 2020.
URL: https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/the-travel-industry-turned-upside-down-insights-analysis-and-actions-for-travel-executives. Reference date: 13.04.2021.

[2] IATA // Airline industry economic performance, 24th November 2020.
URL: https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/the-travel-industry-turned-upside-down-insights-analysis-and-actions-for-travel-executives. Reference date: 13.04.2021.

EBIT margin, % revenue	5.2%	-31.3%	-7.1%
Net post-tax profits, $billlion	26.4	-118.5	-38.7
% revenues	3.1%	-36.2%	-8.4%
$ per passanger	5.80	-66.04	-13.78
Adjusted net debt/EBITDAR	4.60	-7.89	37.17

Note: Current year or forward-looking industry financial assessments should not be taken as reflecting the performance of individual airlines, which can differ significantly.

The governments over the globe have provided the airline industry with financial aid amounted to $173 billion to sustain airlines' operations and solvency. However, the aid covers only about 20% of 2019 revenues, and $91 billion of this aid comes in the form of interest-bearing loans and borrowing guarantees that will ultimately need to be repaid (Refer to tb 1).

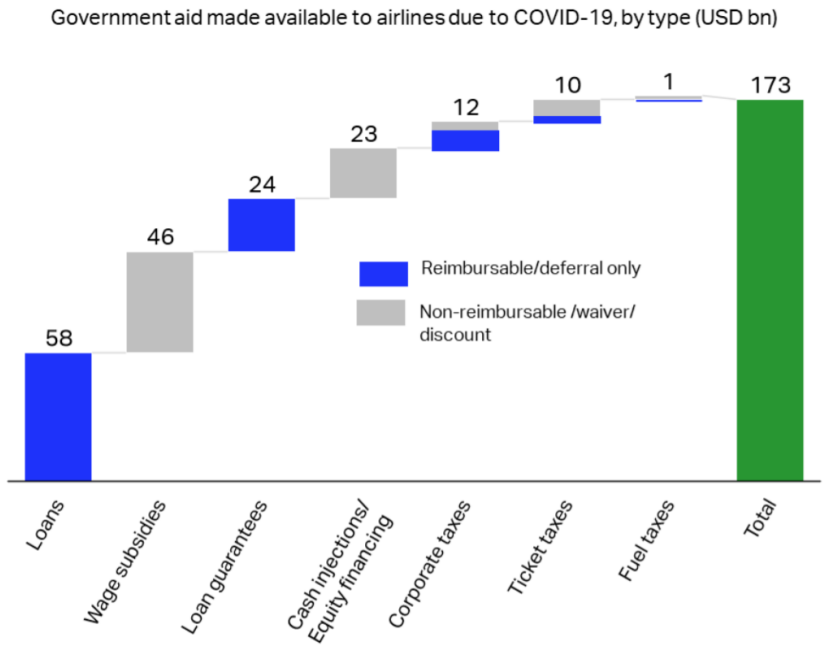

Figure 1. Extract from IATA report on Government aid[3]

Most airlines have encountered unprecedented losses in 2020, and only some have reported profits (for instance, China Airlines, Korean Air and Asiana Airlines), mainly due to their reliance on cargo operations, which grew significantly during pandemic in the respective national economies of these airlines.

Financial performance (which is different from financial health) of the airlines in 2020 disproved by 72% compared to average 2016-2019 rolling scores, according to McKinsey Global Institute's research[4]. Below, in Figure 2, we are providing financial analysis results based on the

[3] Brian Pearce. IATA report "Government aid", 26.05.2020. URL: https://www.iata.org/en/iata-repository/publications/economic-reports/airline-industry-economic-performance---november-2020---report/. Reference date: 13.04.2020.

airline sample used in the current research. It presents key ratios for 2019 through 2020 financial years. If indicator is marked as "n/a", it means that the ratio is invalid due to that numerator or/and denominator is/are negative and ratio cannot be interpreted correctly.

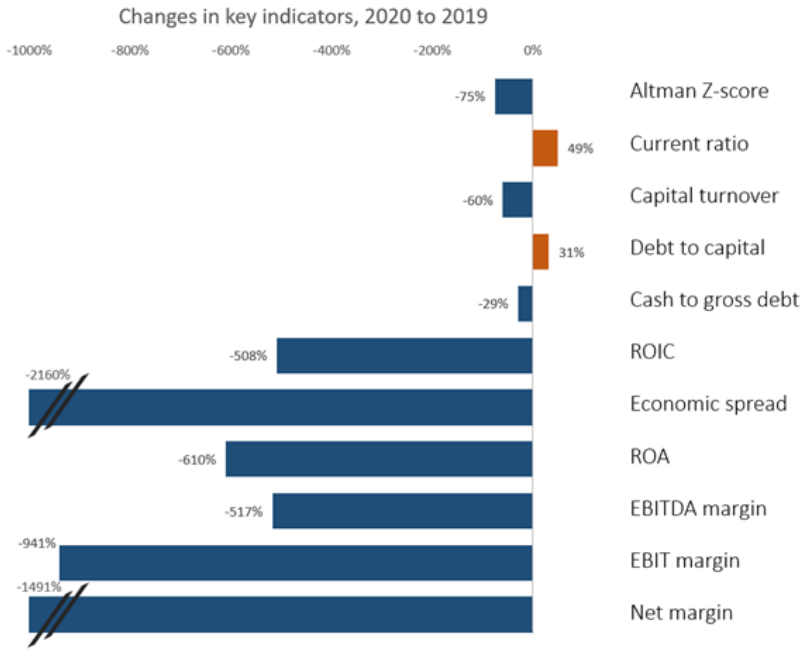

Figure 2. Changes of financial indicators in 2019-2020[5]

- Airlines often have higher leverage due to the specificity of the market. Altman z-score, which identifies tending of a company to bankruptcy, decreased even more in 2020 compared to 2019. Besides, on average, airlines had negative equity in 2020 (which is indicated by debt/capital ratio over 1);
- Current ratio grew by about a half, mainly due to attraction of additional debt funds of the airlines in 2020 but did not reach the target 2:1 compared to other industries;
- Airlines in my sample had excess debt in 2019, and the debt-EBITDA ratio fell substantially due to negative profits and unprecedent debt burden in 2020;
- On average, ROIC decreased from 8% to -32%, with minor decrease in cost of capital (which is indicated by economic spread change of 1% less than change in ROIC). Return on operating capital mainly reduced because of revenue shortfall and decreased EBIT.

In this research, *financial health* is defined as a score which shows how well a company is able to bring long-term value to its investors – to both shareholders and debtholders. It accounts for basic indicators of capital productivity, cost-effectiveness, financial leverage, operating cashflows volatility of the assessed company. The best benchmarks, which can be used to assess whether financial health of a random airline is high or low, are other airlines in the

[5] Source: Author's analysis based on financial statements of 39 airlines

sample. Under financial health we define the performance, ability to attract funds for development and market strengths of the company.

In order to assess financial and operational impact of pandemic, and subsequently map it onto the influence factors, we have applied the following approach:

1. We have generated all indicators which could turn out to be relevant to assessment of airlines' financial performance.
2. Then, we have developed six criteria which would rank financial indicators in terms of their applicability.
3. Selected first 24 (after disaggregation) indicators out of the rank
4. Performed a Principal Component Analysis (PCA) based on data of a sample 12 global airlines. The analysis did not involve 5 first indicators and targeted those ranked from 6^{th} through 20^{th}.
5. Selected 7 financial indicators (5 from screening and 2 from PCA) which would be then used in assessment of financial health of research-wide airlines sample.
6. Some indicators were disaggregated in sub-indicators to simplify the forthgoing analysis of each factor, resulting in total of 12 indicators.
7. 12 indicators were scored against the whole database and then weighted to produce the final score for each airline.

We have generated 76 indicators, which could potentially be used for assessment of financial health of the airline sample. The longlist of those indicators screened through predefined criteria is provided in Appendix 1. Indicators were accepted and further analyzed, only if the following criteria had been met:

- The indicator does not have a strong analogue or a substitute among other indicators in the longlist;
- The indicator does not have a composite among other indicators in the longlist;
- Indicator really measures financial health and is relevant for an airline company.

Then, remaining indicators were scored at a scale of 0 to 5 (Refer to Appendix 1):

20 indicators (before disaggregation) were selected after initial screening. The next step was principal component analysis. We used Realstats excel toolpack PCA.

We have selected 12 global airlines with available and reliable quarterly reports ended September 30, 2020. All items in financial statements were translated into USD dollar the following way:

- assets and liabilities were translated at the currency rate on 30.09.2020;

- equity items were translated at the average rate 01.01.2020 through 30.09.2020;
- the difference was recognized as in equity under Foreign Currency Translation Reserve account.

In sake of representativity, I have selected 4 components within the analysis (Refer to Table 2):

Table 2. Output of PCA[6]

	PCAs	Variance, %	Correlation	Adjusted variance	Cumulative variance
1	Debt to EBITDA	40.306	0.888	36%	36%
2	CFAR	21.567	0.898	19%	55%
3	F-score	12.371	0.215	3%	58%
4	DA to ASK	10.473	0.664	7%	65%

As we can see from the table above, first two indicators account to cumulative variance of 55%. It is under a commonly taken 75%-threshold because we did not account for five indicators which will be used anyway in further research. Thus, we accepted indicators of change in Debt-to-EBITDA and changes in CFAR (Cash Flow at Risk).

The following Figure (2) shows the entire indicators screening procedure:

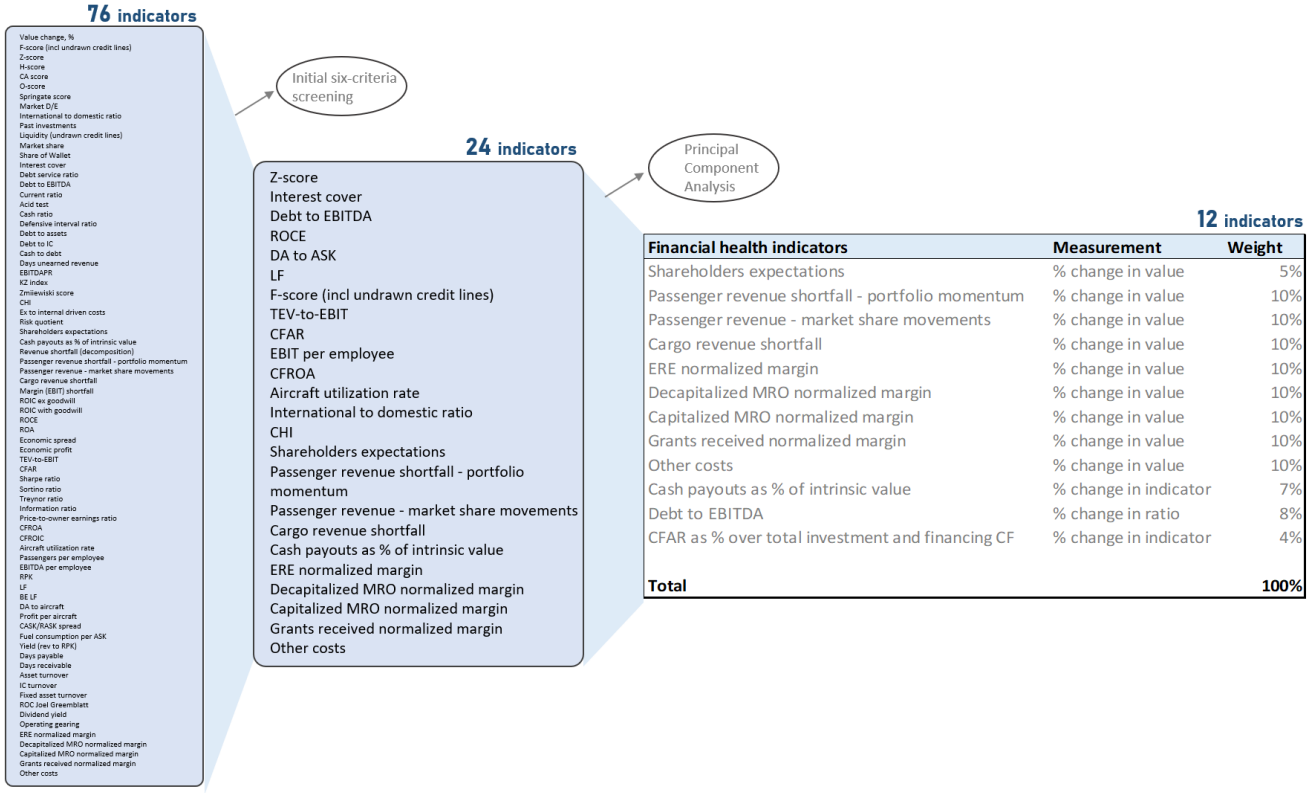

Figure 3. Screening and weighting financial-health indicators

[6] Source: Author's analysis based on financial statements of 12 airlines.

Scoring data was conducted after all necessary input data for 39 airlines were inserted. First, for each of 13 indicators (12 separate indicators + total score), those values out of mean ±3 standard deviations were considered outliers and excluded from the database. Then, these values were normalized to scale of 0 to 1 by using the formula:

Raw value – min value / max value – min value.

Scaling was done to make indicators fully comparable. Then, scaled indicators were weighted as shown is Figure 2 to come to the final financial-health score.

Financial data (mainly financial statements) were sourced primarily from annual reports taken from official airline's websites. They were uniformed and consequently translated from national currency to US dollar using effective FX rates from Bloomberg analytical agency.

Standard deviation of OCF was calculated as sample standard deviation of quarterly operating cashflow for the period of 1 financial year.

To calculate financial health index, most indicators in the score were linked to the changes of Total Enterprise Value of an airline.

Total Enterprise Value (TEV) was calculated as market value of equity plus market value of debt less excess cash. It can be also recalculated using the formula:

TEV = IV + shareholders expectations + interest + dividends, i.e.

MarCap + net debt = IV + shareholders expectations + interest + dividends

Intrinsic value (IV) is calculated as

$$\text{IV} = \text{invested capital} + \frac{invested\ capital\ x\ (ROIC-WACC)}{WACC-longterm\ GDP\ forecasted\ growth}$$

Intrinsic value (IV) decomposition extract is presented in Table 6:

Table 3. Illustrative intrinsic value decomposition[7]

TOTAL VALUE CHANGE DUE TO GROWTH	-40 341
Passenger revenue shortfall - market momentum	-37 003
Passenger revenue - market share movements	3 482
Changes in prices for traffic revenue	-5 487
Cargo revenue shortfall	-133
Other revenue shortfall	-1 199
TOTAL VALUE CHANGE DUE TO COSTS	-274 852
ERE normalized margin change	-161 209
Decapitalized MRO normalized margin change	-17 765
Capitalized MRO normalized margin change	-62 503
Grants received normalized margin change	235
Other costs change	-33 610
TOTAL VALUE CHANGE DUE TO INVESTMENT	943
TOTAL VALUE CHANGE DUE TO WACC	-88 663
TOTAL VALUE CHANGE (ACTUAL)	**-402 913**

[7] Source: Author's illustration of methodology and analysis based on financial statements of 39 airlines.

RECONCILIATION	**-402 913**

Decomposition was done following the rule meaning how much intrinsic value would change if only a particular element of decomposition changed. For instance, intrinsic value of American Airlines Group would decrease by 37,003m USD if its passenger revenues decreased by the same percentage value as in the global passenger flights market (Refer to Appendix 4).

Growth was decomposed using triple decomposition model, i.e. into market momentum, market share changes and price changes. Market momentum constitutes the average growth in revenues at the market level (sum of revenues of 39 sampled airlines). Market share changes mean the growth only due to outperforming the market, i.e. if market growth were equal zero percent. Price changes is average change in number of cents paid for a revenue passenger kilometer.

The next step of analysis is airline sample selection. Type of passenger service (FS, LCC, LX) provided was not included in endowment because majority of the airlines absorbed more than one service type (for example, Aeroflot Group which includes Pobeda, Russia).

Airlines initial set was generated from IATA's website (current members block). Almost all large airlines over the world are currently its members, but to support the longlist, we have also taken a list of airlines (first 100 by market capitalization) from an agency's website[8]. We mapped the two lists against each other to remove any duplicates. The total of 112 airlines were screened against the following criteria:

1. Financial year is ended 31 of December.
2. Financial statements are available for 2019 and 2020.
3. Cargo revenue is <35% of total revenue.
4. Airline is within a holding or group (for example, Pobeda, which refers to Aeroflot Group).

Screening deliverable was acceptance or rejection of the airline for the further scrutiny. 39 airlines were selected for the research. Margins of error for financial health score and regression slope were within t-value of ±2.026, thus the sample is fully representative.

In the entire research, factor is defined as a phenomenon or a feature which is presumably correlated with an airline's financial-health change. In the research, we will study endowment, external and internal factors. Within the scrutiny, the term "measure' relates to internal factors and management's actions to make an impact on endowment or external factors.

[8] companiesmarketcap.com // Online Database "Largest airlines by market cap", 2020. URL: https://companiesmarketcap.com/airlines/largest-airlines-by-market-cap/. Reference date: 07.04.2021.

Each factor – endowment, external and internal – had its own indicator of influence on financial health (hereinafter – impact indicator). Impact indicator is a sub-indicator of financial health score which measures the maximum scope of impact of a concrete factor on total financial health score. Endowment means some features which an airline had prior to pandemic. In my analysis, endowment included five measurable factors:

1. Airline's size which is defined by its portion in the global revenue of 2019, in USD.

2. Corporate Horizon Index (CHI) which is available in proprietary Deloitte's Benchmarks Database[9]. This indicates how long-term oriented a company is and how far strategically it looks ahead. It is calculated as a score comprising the investment to capital consumption, EPS excess growth, Tendency to accruals;

3. Leverage which consists of net and gross debt-to-EBITDA ratios. This factor was further suspended in the research due to that the ratios could not be reliably calculated when EBITDA were negative. Unfortunately, they were such for most airlines in 2020, which makes it hard to compare the ratios.

4. Loyalty and brand power might have given a serious competitive advantage to the airlines which held them high prior to the pandemic. They were calculated using net promoter score.

5. Ownership relates to whether an airline is owned by the government or not. Airlines were classified into state-owned, state-impacted, and private dependently on the governmental power in their shareholding structures. The power was calculated using Shapley-Shubik Power Index, shareholding structures were mainly sourced from companies' official webpages. If it could not be possible to receive a comprehensive shareholding structure, a simple effective interest of government was obtained. If no recent shareholding structure could be found, 0% state ownership was given to the airlines described in media as private; 25% if they were described as associated with government; and 50% if they were described as state-controlled. For description in detail please refer to Table 6.

Table 4. Evaluation of factors' impact[10]

Factor	**Calculation**	**Contribution***
Airline size	.001% revenue to global revenue as of 2019	N/A
Corporate Horizon Index	CHI as of 2016-19	N/A
Net debt-to-EBITDA	Net d/EBITDA as of 2019	N/A

[9] Deloitte's Casey Quirk Database, February 2021. Reference date: 15.04.2021.
[10] Source: Author's analysis based on annual reports, official-website data of 39 airlines and interviews with current German airline's employees.

Gross debt-to-EBITDA	Gross d/EBITDA as of 2020	N/A
Loyalty and brand power	Net Promoter Score	value change due to factor/total score change
Ownership	Classifier, Shapley–Shubik Power Index	N/A

Factor	**Impact indicator**	**Impact indicator 2**
Airline size	total score change	-
Corporate Horizon Index	total score change	-
Net debt-to-EBITDA	total score change	-
Gross debt-to-EBITDA	total score change	-
Loyalty and brand power	value increase due to shifts in passenger market share	total score change
Ownership	total score change	-

* Stands for the method of determining how much the factor impacted the total financial health

Operating and financial data used for identification of endowment factors included the following sources (Refer to Table 7):

Table 5. Description of endowment factors[11]

Factor	**Source and description**	**2020**	**2019**
Corporate Horizon Index	Deloitte's AB Database, measured from 0 to 5 where 0 is the shortest-term and 5 is the longest-term firms	-	4
NPS or related	SkyTrax, marketing agencies databases, published media. Measured normally at scale of 100, where 100 is the highest loyalty	-	68
State ownership	Company's webpage, annual reports, analytical agencies, published media. Classified in 3 types.		0.02

External factors are those which influenced financial health of the airlines from outside of the organization. Mainly, the airlines were unable to control such factors, but some had better chances to receive governmental support if proactively applied for compensation inquiries. Within my research, only regulatory actions were considered external factors.

1. Governmental grants – received or accrued – in P&L (Profit and Loss Statement) of the companies had an impact on NOPLAT (Net Operating Profit Less Adjusted Taxes), and therefore, the value of the airlines. They were used by the airlines mainly in order to cover operating costs and repay the debts or redeemable shares. Except for increased economic profit, it also decreased the cost of debt of the airlines. The impact of the factor was calculated as costs percentage of grants accrued from total operating.

[11] Source: Author's illustration of methodology.

2. Many tax authorities claimed diverse types of tax holidays (temporary release of tax liabilities) for companies operating in the most disrupted industries during the COVID-19 pandemic. Holidays for the following taxes were implemented around the globe: Corporate Profit Tax (CPT), Value-Added Tax (VAT) or sales taxes, withholding tax, social contributions (such as pensions), fuel excises, CO_2 emission tax. Logistic regression was applied to calculate the effect of tax holidays on financial health. If significant tax holidays were claimed (e.g., the entire release from tax liabilities on one particular tax type, like VAT or CPT), the factor was considered positive in the model, or negative otherwise.

3. All airlines were to discontinue eligible flights in 2020, but they could also compensate some of them with flights to other destinations. As this measure could be partially internal, most of destination ceases were caused by the regulatory actions. In the model, the end-of-year number of destinations (not number of flights) was taken to calculate the change of this factor. For description in detail please refer to Table 8.

Table 6. Description of external factors[12]

Factor	**Calculation**	**Contribution**
Governmental grants	% of grants received or receivable from operating costs	value change due to factor/total score change
Tax holidays	yes/not	N/A
Destination suspensions	% decrease in flight network	value change due to factor/total score change
Factor	**Impact indicator**	**Impact indicator 2**
Governmental grants	value increase due to grants received	total score change
Tax holidays	total score change	-
Destination suspensions	value decrease due to passenger revenue	total score change

Internal factors are actions taken by the management of the airline to stabilize and recover the economy of companies. These are the factors (and tools) on which the greatest emphasize is made in my research, because their scope differed significantly from airline to airline and from country to country. One should consider that these measures were applied differently depending on the size of the airline, kind of service provided, jurisdictions and structures of operation, leverage, and other aspects.

1. Some airlines decreased salaries of their employees. The term salary includes the

[12] Source: Author's analysis based on annual reports, official-website data of 39 airlines and interviews with current German airline's employees.

base pay, motivation fees and employee-related taxes or contributions. It is one of the cost-cutting initiatives. Some airlines granted their employees ordinary non-redeemable and redeemable shares except for paying in cash. This was not considered in the model and was accounted for as ordinary employee-related expenditure. Headcount was used to assess the salary, this measure is different from full-time equivalent, but is more available.

2. Some airlines decided to dismiss their employees or put them on long-term unpaid leaves. This measure was aimed at staff costs reduction, but, counterintuitively, employee dismissal only led to repayment of enormous termination benefits (approximately 0.5x of the annual salary).

3. Certainly, due to shortfall in flights performed due to various governmental restrictions, airlines initiated veracious abandonment from previously placed orders for the aircraft. If the airline rejected at least 5% of its 2019 fleet size, or such measurement could not be determined precisely, the airline was considered as cancelling or deferring the fleet orders in sake of logistic regression.

4. The majority of the airlines attracted significant funds from issuing various types of debt instruments (bank loans, bonds, senior notes and analogous) to redirect current funds into covering accounts payable (to fuel suppliers, lessors, airports), wages and salaries, tax and social contributions. For mezzanine instruments, under International Financial Reporting Standards (IFRS) and US GAAP (US Generally Accepted Accounting Principles) reporting, debt component is separated and accounted for as debt proceeds apart from the equity proceeds. Thus, there was no need to adjust and reallocate the proceeds within debt and equity categories.

5. Some airlines also made a decision to attract funds from the current and new shareholders – via issuing of ordinary and non-redeemable shares, investment certificates and other equity instruments. Equity element of proceeds from issuing mezzanine instruments was accounted separately under the reporting standards (IFRS and US GAAP) applied to financial statements of the airlines which I selected for my research.

6. Some airlines also restructured the current debt instruments, especially bank loans, to decrease the debt burden in 2020. Such restructurings could include prolongations, toggle notes, PIK (pay-in-kind) notes, refinancing or lease holidays. To figure out whether the airlines applied this measure, I have calculated the decrease in ratio of debt repayments to gross debt.

7. Airlines around the world used diverse pricing strategies in order to maximize the revenue and load factor of passenger flights. Changes in net price of revenue passenger kilometer show which strategy (price increase or decrease) the airline followed during the pandemic and

how it has finally performed because of these measures. Since the indicator of success for this metric is decrease of company's value due to changes in passenger revenue, this way of assessment takes price elasticity of demand into account.

8. Almost all airlines sold their assets for sake of highly needed financing. Those assets mainly were financial instruments (both debt and equity held for speculation and strategic purposes) and fixed assets (repairable aircraft spare parts, buildings, car fleet, other property). This internal factor was also taken into the research.

9. Approximately 70% of the global fleet was grounded during the first quarter of 2020. Thus, the aircraft did not need as much technical inspections, repair, maintenance and overhauls as the previous year. Deferred maintenance grade was identified as positive percentage excess of decapitalized and expensed MRO expenditures over the decrease of revenue. Considerable portion of MRO expenditures is capitalized in right-of-use assets and in property, plant and equipment accounts, therefore this portion was extracted from there and reclassified to expense in order to identify whether any deferred maintenance existed.

10. Some airlines re-concluded their direct and indirect procurement contracts, mainly by inferring deferred payment conditions and ceasing unneeded service contracts. Decrease in days payable was used to identify such measure of renegotiation and suspensions of unneeded supplier contracts.

11. As cargo operations were more demanded in 2020 compared to 2019, airlines could increase their freight operations in three ways:

- Remodify the passenger aircraft to cargo aircraft
- Order new cargo aircraft from the lessors
- Use currently held passenger aircraft for freight purposes

The research is to find out which of these measures was most effective, but the last measure (Use currently held passenger aircraft for freight purposes) could not be reliably determined for most of airlines and was finally abandoned for the scrutiny. If there was any published indication that the airline ran passenger fleet modifications to cargo aircraft, the measure was considered as positive for logistic regression.

12. Alike the previous measure, if there was any published indication that the airline ordered more than 5% of its current cargo fleet, the measure was considered as positive for logistic regression.

13. If there were any airline which did not undertake any internal measure, it was marked as not applied any of the measures considered for other airlines in the research in sake of logistic regression. For description in detail please refer to (Appendix 3).

We will disclose the methodology and outputs of the analysis studying the impact of three types of factors from the previous chapter on airlines' financial health.

1. We have conducted four data refinement procedures to ensure the deliverables of the model are correct and reliable. Such procedures included:

2. Sanity checks for financial data (WACC>long-term growth, assets – equity – liabilities = 0, TEV > 0).

3. Eliminating outliers (unscaled values with ±3 sample standard deviations from the mean).

4. Scaling (both financial impact and actions taken data were scaled from 0 to 1 in order to make it applicable for further regression analyses).

5. Reversing the data (this step is to make the observations fully comparable and to make the research conduct with the intuitive logic: the higher the measure score the higher the impact score – i.e. financial health. Reverse measures were, for example, destination suspensions, assets disposal, deferred maintenance, as they showed higher financial health as their measure score decreased).

We applied linear, polynomial and logistic regressions to find out relationships: a) between the factors and impact indicators and b) between the factors and financial health score of the airlines. All data were screened through the following criteria:

- No multicollinearity (VIF, reference value is under 5);
- No heteroscedasticity (Breusch-Pagan test and White test, reference value is over 0.05);
- Normality of regression residuals (Shapiro-Wilk Test, reference value is over 0.05). If data did not comply with this criterium, they were refined using Chebyshev's rule unless the data become normally distributed;
- Linear or polynomial dependence (R^2, reference value is over 65%);
- No autocorrelation (Durbin-Watson test, reference value is under 77%).

For accuracy of results' evaluation, I used Root Mean Squared Error (RMSE) indicator, which is the mean squared differences between actual and predicted financial health score. Accuracy is defined as 1 – RMSE. Since the aim is to ensure that there is relationship between factors and heath, accuracy is defined with RMSE better than with R^2 as it is not sensitive to outliers and better generalizes the trend.

Impact was defined as:

- For linear regression – relative change in financial health score as result of 1-percent change in factor, i.e. the slope of regression line since all data are scaled from 0 to 1;

- For polynomial regression – average absolute slope of polynomial extrema, of $(y_{ext0} - y_{min})/2$, of $(y_{exti} - y_{exti+1})/2$ and of $(y_{max} - y_{exti+n})/2$;
- For logistic regression – slope at inflection point.

In order to exclude the impact of other factors, financial-health sub-indicators unrelated to the assessed factors were taken as of 2019, not 2020 – i.e. under the assumption that only this factor impacted the health – which implied zero health change for these sub-indicators. Sub-indicator related to the assessed factor was taken as of 2020. Factor-related sub-indicators can be found in Tables 9, 11 and 13 and all other sub-indicators in Figure 3.

The following factors were accepted as highly influential on their relative impact indicators of an average airline in 2020 (highlighted in Table 9).

Table 7. Output of regression analyses[13]

#	Factor	Category	Linear regression 1 - RMSE	Logistic regression 1 - RMSE	Polynomial regression 1 - RMSE	Final evaluation 1 - RMSE
1	Governmental grants	external factor	69%	n/a	58%	69%
2	Tax holidays	external factor	n/a	29%	n/a	29%
3	Destination suspensions	external factor	93%	n/a	79%	93%
4	Salary per employee change	internal factor	57%	n/a	31%	57%
5	Employee dismissal	internal factor	85%	n/a	70%	85%
6	Cancelling or deferring aircraft orders	internal factor	n/a	16%	n/a	16%
	… (continued in Appendix 6)	…	…	…	…	…

We can make the following conclusions based on the results of analysis:

1. The more the revenue an airline generated prior pandemic, the more chances it had to obtain stronger financial health in 2020, compared to the peers. It can be explained by the environment which is inherent to the aviation industry – the-winner-takes-all. Basically, bigger airlines win more lucrative governmental contracts and receive more active compensations from regulatory body. Also, these airlines had lower leverage (ratio of fixed and variable costs), thereby were more flexible and better prepared for the crisis.

2. More customer-centric airlines performed on average better on financial health than those with lower customer loyalty scores. It can be also explained by the advertising investments the airlines made in the past. It predominantly refers to such airlines as Lufthansa, Emirates or Delta Airlines, which made a significant investment in awareness and brand loyalty.

[13] Source: Author's analysis based on annual reports and official-website data of 39 airlines.

3. The airlines which were granted or compensated costs or losses from governments or governmental organizations had stronger financial health in 2020, mainly due to directing the received funds to cover excess operating costs, repay the debts or preferred shares and establish recovery strategies in the third and fourth quarters of 2020.

4. Apparently, regulatory flight suspension was the biggest driver of financial performance of the airlines around the world. This factor has the direct influence on revenue of the airlines, reduction of which was the key reason for losses made during the pandemic.

5. Surprisingly, the airlines which kept the major part of its headcount performed much better on financial health compared to the airlines which dismissed over 10% of the staff. It can be mainly supported with the fact that staff dismissal may provoke high increase in liabilities due to accrual or repayment of termination benefits.

6. Airlines which disposed most of their assets (predominantly leased aircraft and repairable spare parts) before May of 2020 created higher value to their stakeholders. These airlines had a chance to dispose considerable value of their lease liabilities, as well as right-of-use assets, which naturally increased their ROIC compared to the airlines which did not dispose the assets proactively.

7. There were two approaches undertaken by airlines which concerned strategic refocus from a portion of passenger market onto the cargo operations. The first approach was fast remodification of a part of the fleet from passenger to freight operations. The second was disposing passenger aircraft and proactive ordering cargo fleet. The research showed that the airlines which followed the second approach managed to outperform the peers on financial health.

The factors which were strongly impactful with their impact indicators were selected at threshold of 65-percent dependency. Then, these factors, their impact on financial health score was assessed. This was done by conducting regression with factors and financial health score. Output of contribution and regression analyses are shown below in Table 10 (There is no negative impact due to factors reversibility assumption):

Table 8. Impact of factors on financial health[14]

Factor	**Category**	**Dependency[1]**	**Contribution[2]**	**Impact[3]**
Destination suspensions	external factor	93%	0.74	72%
Employee dismissal	internal factor	85%	0.21	17%
Cargo fleet expansion through leasing	internal factor	84%	0.32	33%

[14] Source: Author's analysis based on annual reports and official-website data of 39 airlines.

Loyalty and brand power	endowment	84%	0.12	12%
Disposal of the assets	internal factor	78%	1	84%
Airline size	endowment	73%	1	76%
Governmental grants	external factor	69%	0.13	10%
Decreasing average employee salary	internal factor	57%	0.45	n/a[4]
Net debt-to-EBITDA	endowment	49%	1	n/a[4]
Increased prices	internal factor	44%	0.26	n/a[4]
Ownership	endowment	43%	1	n/a[4]
Fleet remodification	internal factor	39%	0.11	n/a[4]
Drawing down additional finance (equity)	internal factor	39%	1	n/a[4]
Deferred maintenance	internal factor	39%	0.08	n/a[4]
Gross debt-to-EBITDA	endowment	36%	1	n/a[4]
Tax holidays	external factor	29%	1	n/a[4]
Drawing down additional finance (debt)	internal factor	24%	1	n/a[4]
CHI	endowment	19%	1	n/a[4]
Cancelling or deferring aircraft orders	internal factor	16%	1	n/a[4]
Renegotiation of contracts	internal factor	16%	1	n/a[4]
Won bank holidays	internal factor	10%	1	n/a[4]

[1] accuracy of regression model between factor and its impact indicator, 1-RMSE

[2] contribution of factor impact indicator to total financial-health score

[3] impact of factor on financial health score

[4] unreliable dependency level

Factors include direct and indirect measures. Direct measures are internal and are driven only by the decisions of management. Indirect measures (i.e. management's actions, tools) are external and endowed, they can be influenced through other management actions – for example, applying for governmental subsidies or decreasing debt burden via preferred shares redemption and operational transactions factoring.

It is important to note that dependency measured as 1-RMSE does not imply causation. The factors (independent variable) and financial health (dependent variable) can be indeed interdependent, financial health could make a reverse impact on factors, or there could be another third factor which influenced factors and financial health independently. However, common sense check and outputs validation with employees and middle management of an airline were conducted in order to verify that factors can high probably cause the respective change in financial health.

The model tested inexhaustive number of factors which had an impact on financial health of the airlines. There were other measures undertaken out of the scope of the current research. The most influential measure is strong cost-cutting program. This measure is partially scrutinized under the factor “Renegotiation and suspensions of unneeded contracts”, but it can also cover such management actions as digitization of customer-experience processes, automation of internal processes, establishing dynamic pricing, creating analytical centers to increase the quality of managerial decisions. These factors were not covered in my analysis as they are hardly extractable and cannot be reliably measured. Besides, each airline has its own cost structure, thus such comparisons should be conducted cautiously.

An example of endowment factor which influenced financial health of the airlines in 2020 is dependency of key cost items on currency rate changes. This is relevant to non-US airlines which lease aircraft in US dollars, for example, Aeroflot Group. Russian ruble weakened by 19% by 31 December of 2020, which caused a significant loss of 99 billion rubles from revaluation of lease liabilities and a 11-billion increase of annual depreciation expense. So, comprehensive loss from USD/RUB rate fluctuation is estimated to be 110 billion rubles, which is 36% of Aeroflot’s revenue in 2020.

Other endowment factors can include, for example, organization health of the organization – i.e. its ability to execute, align and improve itself faster and better than competitors which creates a compelling long-term value for the key stakeholders of the company.

Most financially healthy airlines in the research sample were Vietnam Airlines, Pegasus, Aeromexico, Azul Group, China Southern Airlines and China Eastern Airlines.

To sum up the research, the passenger airlines shaped a group of companies which were severely impacted by the pandemic in 2020. Their financial health deteriorated substantially: airline companies produced colossal losses, undertook unprecedent debt burden and suffered from tremendous passenger demand shortfall. Some companies, for example China Airlines, Korean Air and Asiana Airlines, managed to earn net profit at the end of 2020. There were also airlines which loss was minor – within 5% of revenue. The aim of my research was to figure out which actions the stakeholders could take in order to minimize the effect of continuous pandemic on financial health of the passenger airlines.

Financial health was defined in this research as a scored combination of profitability, capital efficiency, cost of capital, shareholders expectations and debt leverage. We conducted series of regression analyses to identify the most successful measures which enabled some airlines outperform the peers during the new pandemic inflows. Common sense and deliverables

of regression shaped the following set of insights, which airlines may consider for developing operating strategies during the lasting ongoing covid constraints:

1. Airlines which disposed most of their assets before May of 2020 created higher value to their stakeholders. Airlines can be better executing contracting economic strategies with the lessors and key suppliers, as well as continuously monitor the asset health to proactively and quickly identify the groups for sale or renting out.

2. Large in terms of revenue airlines were more likely to outperform their smaller peers in 2020. That means the airlines should be more growth-centric in order to survive in such large disruptions.

3. Regulatory flight suspension was pivotal for revenue generation and value creation of the airlines. Here, the airlines should be able to modify their flight network faster than competitors.

4. The research showed that the airlines which disposed passenger aircraft and proactively expanded the cargo fleet managed to outperform the peers on financial health in 2020. So, the airlines might consider proactive sale of new cargo aircraft in case of structural market changes instead of hard fleet remodification.

5. Airlines which kept the major part of its headcount performed much better on financial health compared to the airlines which dismissed over 10% of the staff. Airlines should accurately analyze whether termination employee benefits overweight the currently paid salaries to the staff, considering the expectations about the lasting period of pandemic.

6. Governmental support during pandemic made a substantial impact on sustaining operations of financial-health leaders in the airline services market. Airlines should apply for governmental aid with high quality of execution to cover the sunk costs incurred.

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