Has Risk Capital Increased Airlines Capabilities to Respond to Crisis

Pre-pandemic risk capitals' ability to mitigate the Impact of COVID-19 on employees and investments

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Abstract

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Keywords: Economic capital, risk capacity, Covid-19, airline industry, financial constraints,

Purpose: This paper aims to empirically investigate if pre-pandemic risk-capital was able to mitigate the negative impact of the COVID-19 pandemic on employees and investments in the airline industry

Method: The base econometric methodology used is multiple regression analysis with the four risk capitals interacting with a dummy variable for the year 2020 when the COVID-19 pandemic hit.

Theory: The broad theoretical framework is based on financial constraints and risk capital in the form of economic capital and risk capacity.

Empirical foundation: 399 firm-year observations from the airline industry between 2016 and 2020 make up the empirical foundation of this paper.

Conclusions: Liquidity in the form of cash reserves was proven to be the most efficient risk capital at absorbing revenue shocks and mitigating reductions in both employees and investments in the airline industry. Moreover, economic capital in the form of a higher equity ratio had a positive relationship with investments. No strong support was found for cash margin or operating flexibility to have any buffering effects.

1. Introduction

In this chapter, a brief background of the area of the thesis is provided. In section 1.2, the research question of the thesis is presented, which is followed by section 1.3 in which the purpose of the thesis is discussed. The chapter concludes with a presentation of the scope of the thesis and the outline of the thesis.

1.1 Background

In December 2019, the first human case of COVID-19 (SARS-CoV-2) was reported by the officials of Wuhan City in China (World Health Organization, 2020). Governments across the globe were forced to impose lockdowns and restrictions of movement to prevent the spread of the deadly COVID-19 virus. The global economy faced an unprecedented shock caused by the rapid spread of the COVID-19 virus as it was associated with a high-scale disruption to companies' business operations. The characters of the COVID-19 pandemic can be described as an event that had never happened before and was impossible to predict and make risk adjustments to. Thus, Brzeszczynski et al (2020) classify the COVID-19 Pandemic as a Black Swan event. A Black Swan event is defined as an event that comes out of blindsight and has a major impact on business (Brzeszczynski et al., 2020). The COVID-19 virus has therefore been described as the newest risk that has disputed business operations across all industries. The airline industry was one of the first industries affected by the COVID-19 as governments prohibited cross-country transportation (Maneenop and Kotcharin, 2020). This ban on transportation resulted in disruptive revenue shocks due to heavily reduced ticket sales. The shock caused airlines to become strapped for cash, and several major bankruptcies ensued in the industry. (Dube et al. 2021). Cashflow is a prerequisite for survival but could some airlines have prevented this outcome from taking tail risk, i.e., low probability-high impact events, into consideration?

Alviniussen and Jankensgård (2009) propose that firms can utilize loss-absorbing buffers of financial resources to defend themselves against tail risk and therefore preventing financial constraints. Financial constraint is challenging to observe, but Fazzari et al. (1988) suggest it can be possible to infer from differences in observed investment sensitivity. Christine and Jankensgård (2021) instead take a different approach when using employees as a proxy when measuring the effectiveness of financial buffers defined as risk capital. Large reductions in the number of employees would imply the firm must make deep and costly adjustments to its strategy.

1.2 Research question

The COVID-19 outbreak has had a large impact on the airline industry and this study, therefore, aims to explore how pre-covid risk-capital affects the airlines' capabilities to sustain a revenue shock. Specifically, if these risk capitals can mitigate firms' need to engage in employee downsizing and cuts to investment. Therefore the research question of this study is the following:

- How did pre-covid risk-capital affect the airline's capabilities to sustain revenue shock caused by the COVID-19 pandemic?

Following are the two sub-questions to the research question.

- Can risk-capital mitigate the firm's need to engage in employee downsizing?

- Can risk-capital mitigate the firm's need to make cuts in investment spendings?

1.3 Research purpose

The purpose of this thesis is primarily to expand on the existing literature on risk capital since a firm's ability to deal with tail risk is an under-researched topic in the literature of corporate risk management. This thesis will contribute to the literature by answering how pre-covid characteristics affect airlines' capabilities to sustain revenue shocks. Further, it will provide an understanding of how risk-capital adjustments can mitigate the firm's need to engage in employee downsizing and reduced investments when revenue decreases.

The existing literature has conceptualized and researched risk-capital in various forms. Nocco and Stulz (2006) have defined risk-capital in terms of equity capital and have associated it with a certain probability of financial distress. Christine and Jankensgård (2021) define risk capital as a buffer that helps companies absorb and mitigate revenue shock without harming their strategy execution.

This study aims to complement Christine and Jankensgård (2021) latest research by introducing risk capital relation to firm investments while also applying their methodology to the latest economic downturn and in a specific sector that was hit extra hard. Moreover, the COVID-19 impact has been extensively researched (Shen et al., 2020). Still, this study adds by providing evidence how pre-

pandemic capital can absorb and mitigate the revenue shock caused by the pandemic, thereby allowing companies to avoid doing substantial cuts to operations.

The airline industry was one of the first industries impacted by the COVID-19 pandemic, reducing air travel capacity by roughly 60-80% during 2020 (Sobieralski, 2020). This factor makes the airline industry an ideal sector to investigate how the pre-pandemic characteristics can mitigate the revenue shock caused by the COVID-19 pandemic. Further, compared to other COVID-19 studies, this study will investigate the-year end difference between 2019 and 2020. Changes in employees and investment can take time to implement. Thus this study allows for the structural impacts caused by the pandemic to materialize due to the increased time period. Therefore, the purpose of this thesis is also to add more robust data to the existing literature on the COVID-19 impact on firms.

1.4 Scope

The sample in the paper is limited to public airlines since they produce sufficient amounts of financial data. Private airlines proved only to display necessary financial ratios on a case-by-case basis, reducing the comparability between firms over the time period. Only including public airlines also reduces the representation from Africa and South America due to their less developed capital markets and smaller-sized airlines.

2. Covid airline industry

In this chapter, a brief introduction is given to the COVID-19´s impact on the airline industry and how the airline industry has responded to comparable black-swan events.

The airline sector plays a crucial part in facilitating the movement of people and goods across the globe. It provides rapid transportation of tourists, cargo such as medical supplies, and other essentials (Fung et al., 2006). However, the Covid-19 Pandemic has reduced the mobility of people worldwide, which has caused a negative shock to the airline industry (Sobieralski, 2020). The airline industry has historically been an industry with steady yearly growth, but it's also sensitive to stresses such as natural disasters, political instability, and pandemics. In recent decades there have been three crises in particular that made the sector suffer from a major negative growth rate. The first major negative shock was the Gulf Crisis in 1990/91, when the flight demand decreased due to the Gulf war. The second was the September 11, 2001 (9/11) attack when a plane was hijacked in order to attack the US, which resulted in a scare in the market, and ticket sales decreased as a consequence. Finally, the financial crisis of 2007/09, when the global financial market crashed, resulted in people spending less money on travel, and the demand decreased (Sobieralski, 2020; Franke and John, 2011). After the 9/11 crisis, US airlines impartially initiated massive restructuring to reduce their operating cost and fixed cost. This resulted in major layoffs, renegotiations of labor contracts, and renegotiations of the aircraft leases (Von Nordenflycht and Gittell, 2013). Additionally, Von Nordenflycht and Gittell (2013) presents data that shows that the number of employees also decreased as a consequence of the global financial crisis in 2007/09.

According to Sobieralski (2020), the global air travel capacity was reduced by roughly 60-80% in 2020, and the demand is expected to remain low. One key reason why airlines struggled to sell tickets to consumers was the governmentally imposed travel restrictions to prevent and reduce the spread of the deadly virus. For example, the United States enforced several Presidential proclamations to suspend and limit entry into the United States (Centers for Disease Control and Prevention, 2021). This impact hit the air travel industry hard due to a decrease in capacity and flight cancelations (Sobieralski, 2020). To ease the financial constraints on airlines, governments deployed massive relief and rescue packages to the industry, amounting to US $123.1 billion globally. North America received the largest share of this total amount, constituting 25%, followed by Europe and Asian Pacific receiving 15% and 10% respectively. Latin America only received 1% and Africa and the Middle East even less. The airline industry has inherently high fixed costs, and the subsidies were intended to relieve those, but the aid amount was far from sufficient, barely constituting 25% of airlines' 2019 revenue. The cash burns far

exceeded the aid amount, and the sector suffered greatly as a consequence, with more than 16 major airlines such as South African Airlines, German Airways, Virgin Australia, and AirAsia all filing for bankruptcy since March 1, 2020 (Dube et al. 2021).

As the reduction in capacity and decrease in demand continues in the airline industry, the uncertainty of the future of the employees has increased. Earlier studies such as (Sobieralski, 2020) argue that the employees of major airlines are likely to be impacted by revenue shocks. Sobieralski (2020) argues that employee downsizing is the most likely response to a decreased capacity and revenue shock in the airline industry. In fact, his study suggests that approximately 7% of the major airline employees will be impacted by the revenue drop. Important to be aware of is that Sobieralski´s (2020) study was conducted in an early stage of the COVID-19 pandemic (April 2020), and the impact is likely to be even more pronounced today.

According to Wojahn (2012) the airline industry is known for over-investing. Even though the airline industry has failed to cover the cost of capital since 1999, the fixed capital has increased every year. However, the results from Wojahn (2012) study indicate that when the airline industry has suffered from a drop in revenue due to the three shocks previously mentioned, the net capex also decreased from the previous year. According to Vindo (2020) the airline industry is very asset-intensive as the assets namely the airplanes are expensive and thus heavily leveraged. Therefore, the airline industry is strapped for cash, and cash-flow is a prerequisite for their survival. The industry was already highly levered in 2019, and the problem was further exacerbated in 2020 by 55% of governmental aid, creating additional debt (Dube et al. 2021).

3. Theoretical background

In this chapter, the theoretical background of the thesis is presented. Section 3:1 explains the concept of financial distress and constraints. Section 3:2 explains the theoretical concepts of risk capital.

3.1 Financial distress and constrain

A common argument in literature for firms to utilize risk management is to hedge against the risk for a firm to fall into financial constraint and distress. Corporate defaults, bankruptcies, or just a company struggling to meet its financial obligations, can all impose serious costs for firms. The cost of default is a necessary component to understand in order to understand the joint behavior of credit spreads, optimal financing decisions, or the firm's ability to pursue its strategic goals (Almeida et al, 2011).

Financial constraint and distress can be caused by macro-level factors, industry factors, and by a firm's own actions. Bernanke (1981) highlights the relationship between recessions, change in liquidity, and financial distress. The risk of bankruptcy plays a critical role in the propagation of recessions due to firms taking action to retain sufficient liquidity to meet fixed expenses. This high uncertainty regarding future liquidity needs decreases demands for illiquid and long-lived assets, which constrain income in the whole supply chain further. The financial constraints may last until actors gain new information to resolve the ambiguity caused by the initial income fall.

Financial distress can instead propagate in a specific industry and not the economy as a whole. A shakeout of firms in the industry will eventually occur if a negative shock to product demand is sustained over time. Mitchell (1996) argues this will force weaker firms to file for bankruptcy or consider being acquired by stronger firms in the industry. The frequency of restructuring activities and takeovers are therefore directly related to economic shocks borne by the industry. A bankruptcy announced by one firm also affects the valuation of other firms in the industry (Lang and Stulz, 1992). The contagion effect arises when a bankruptcy announcement exposes new negative information about the industry, which brings down the value of other firms as well. When a sector is heavily leveraged, or the stock returns are strongly correlated, the contagion effect becomes extra strong. However, highly concentrated industries with low leverage tend to experience slightly positive valuations due to the rivals gaining market shares in the absence of the bankrupt firm.

3.2 Risk Capital

Although all companies are affected by macroeconomic- and industry shocks, firm-specific factors can help mitigate the negative impact. Alviniussen and Jankensgård (2009) outline how firms can decide to retain loss-absorbing buffers of financial resources to defend themselves against tail risk in the form of high-impact exogenous shocks. These loss-absorbing buffers are called risk capital and are defined as buffers of liquidity used in a worst-case scenario. Christie and Jankensgård (2021) further argue that risk capital should be understood as any buffer that helps companies absorb and mitigate the impact caused by revenue shocks, thereby allowing companies to continue executing their strategy without any negative impact. Risk capital can further be divided into Economic Capital which relates to solvency, and Risk Capacity, which relates to liquidity (Alviniussen and Jankensgård, 2009).

3.2.1 Economic Capital

It is difficult to assess a company's risk of falling into financial distress without quantifying and conceptualizing some concept of the company's economic capital (Alviniussen and Jankensgård, 2009). Economic capital is essentially the amount of equity capital the business requires to ensure they remain solvent given the riskiness of its assets and operations. Nocco and Stulz (2006) describe Economic capital as a buffer that aims to ensure the company’s survival in case of a worst-case scenario. Economic capital is used to protect the company from potential losses and keep the company solvent. The purpose of Economic capital is to absorb potential equity-depleting losses.

High-quality equity such as retained earnings and share capital has the feature of reliably absorbing losses and carries no fixed payment. On the contrary, highly leveraged firms are more vulnerable to negative shocks to performance (Chodorow-Reich, 2014). However, there is a significant cost associated with having much economic capital in the company. Thus, it is essential that the economic capital reflects the risk that the company is exposed to in order to remain solvent (Nocco and Stulz, 2006).

3.2.2 Risk Capacity

Risk capacity can be described as the combined “weaponry” of resources that a company possesses to maneuver its business in difficult times without being forced to make costly adjustments to its business activities. Some of the factors that will have an impact on the company's flexibility and its ability to deal with difficult business conditions are the financial resources, the quality of their assets, and the management teams’ reputation in the capital markets (Alviniussen and Jankensgård, 2009).

In order to narrow the concept of risk capacity and to be able to understand how the risk capacity is used operational in financial analysis, Alviniussen and Jankensgård (2009) conceptualize risk capacity as a function of three different objects. First of all, it is the amount of liquid assets that are available, which refers primarily to cash and cash equivalents and also assets that can be turned into cash on short notice without any fire-sales. Secondly, the spare debt capacity, which refers to the company's ability and capacity to utilize additional debt. Lastly, the hedge position, which refers to the ability to take on an investment position intended to offset potential losses or gain by making a companion investment.

In order to assess the risk capacity, it is important to understand how the company can manage its commitments and implement value-creation investments during times of volatility. Therefore the main focus is on how the company can deal with worst-case situations which can threaten the survival of the company. Thus, Alviniussen and Jankensgård (2009) argue that risk capacity is similar in spirit to economic capital as it is used to understand how well the company can resist losses. It investigates how much capital a company needs in order to support its growth and other activities that entail risk. However, these concepts are different as economic capital does not take debt capacity into consideration.

Alviniussen and Jankensgård (2009) argue that in order to frame the total risk, companies need to quantify their Risk Capacity. The lower the risk capacity a company has, the higher the probability is that the company will suffer from consequences if a situation with low cash flow occurs (e.g., when a black swan event occurs).

4. Literature review and Research Hypothesis

In this chapter, existing literature on the topic of the thesis is reviewed on which the hypothesis of the thesis is developed. Section 4:1 reviews how employment is impacted by financial constraints. Section 4:2 reviews how investments are impacted by financial constraints. In section 4:3, the hypotheses are developed based on the reviewed literature.

4.1 Employment during financial constraints

There are several papers that describe the complex relationship between finance and employment ability (Friedrich and Zator, 2020). One of the relationships between finance and employment can be seen through the concept of labor hoarding. Leslie and Laing (1978) describe the concept of labor hoarding is when a company has a labour force that exceeds the amount of labour needed in order to meet the market demand. The concept of labour hoarding suggests that it is more cost-efficient to hoard labor than the cost associated with hiring, firing, and training. Reducing the quit rate would reduce the company's cost of recruiting and training. Thus, it might be cheaper for the firm to hoard labour even when demand decreases. Clearly, there is a tradeoff between the wage cost associated with the hoarded labour and the saving in hiring and training. The labor hoarding process entails a reduction in profitability for companies during short-term falls in revenue, however, the company retains and ensures that the employees are available when the growth later resumes. Under conditions of uncertainty Leslie and Laing (1978) however, argues that companies that are risk lovers are more likely to engage in labour hoarding and companies that are more risk-averse are more likely to reduce their labour hoarding.

However, a later study conducted by (Sharpe, 1994) suggests that labor hoarding is limited when a company has restricted access to cash and experiences financial constraints. Further, Sharpe (1994) suggests that companies that are smaller and more highly leveraged will be more impacted by a shock in revenue and as a consequence would need to reduce their labour hoarding in order to conserve their working capital when revenue drops. The employment rates in companies are highly influenced by the financial situation of the company. When financing is constrained companies need to adjust their capital and the employment rate depending on the demand in the market. The advantages of labour hoarding, with the lower cost associated with the recruitment process, will pay off when the demand and growth of the company resume. This implies that the future return needs to be financed in advance, thus, labour hoarding can be seen to share similar characteristics to capital investments. When the finances are constrained and the internal funding capability decreases, the likelihood of employee downsizing increases (Kao and Chen, 2020).

Restricted access to credit will ultimately affect the employment rate and the ability to engage in labor hoarding. It is also argued that the financial condition will affect the employment rate and access to employees (Friedrich and Zator, 2020). Giroud and Mueller (2017) present results that indicate that financial constraints decrease the company's ability to retain labour and engage in labour hoarding.

4.2 Investments during financial constraints

Modigliani and Miller (1958) suggest that in a perfect capital market, the way companies finance themselves does not have any effect on investment decisions. Thus, companies' investment decisions would be independent of financial factors such as debt leverage and liquidity. Hence, companies will engage in investments until their marginal revenue equals their marginal cost, in order to maximize company value (Modigiliani and Miller, 1958). Further, Hall and Jorgensson (1967) introduce the neoclassical investment theory, which suggests that the intertemporal problems could be solved regardless of the financial factors of the company.

However, Fazzari et al. (1988) paper argue that the financial factors of the companies do affect the investments. Their paper indicated that in all companies in their study, investments in general, are affected by the financial situation. Cleary (1999) came to the same conclusion that there is a relationship between a company's investment and the financial status of the company. The result from their study indicates that investment rates are sensitive to liquidity and the availability of internal funds. The relationship between investments and liquidity and cash flow is created by the asymmetric information between the creditors and corporations. When companies use external financing, they pay a cost premium, hence companies prefer using internal funds such as retained earnings instead of external financing (Almeida and Philippon 2008). External financing such as debt is also impacting the operating flexibility of the company, as external financing commits companies to interest and amortization payments (Fazzari, 1988).

When firms face financial constraints, they are likely to have a negative shock in cash flow and liquidity that will impact and reduce access to internal funding. The internal funding has a cost advantage over new equity and debt, thus, the company will lose its access to lower-cost financing (Fazzari et al., 1988). In these circumstances, companies may choose not to engage in any investments in order to avoid the high-cost premium that external financing often entitles. In consequence, negative shocks to cash flow

can potentially lead to under-investment. With this evidence, a relationship between financial constraints and companies' investment rates can be identified.

4.3 Hypothesis Risk Capital

4.3.1 Leverage

The capital structure of a company helps as a buffer to absorb and reduce the impact of revenue shocks. Companies that have financed their assets with equity are more likely to resist revenue shocks. On the contrary, companies that finance their assets with debt have a higher level of fixed cash commitment in the form of interest rates and amortization. High debt would increase the fixed cash and the threat of bankruptcy would increase. However, when a company finances its assets with equity, they decrease the fixed commitments and decrease the risk of bankruptcy. Additionally, it would also increase the debt capacity during times of revenue drops (Stulz, 1996). Giroud and Mueller (2017) that companies that have high leverage are likely to be more financially constrained, which will decrease the company's ability to engage in labour hoarding. This indicates that companies that are highly leveraged face a higher risk of employee downsizing if revenue decreases. Hence, companies with high financial slack would be more likely to benefit from engaging in labour hoarding for long-term optimization.

In contrast to the indications from Stulz (1996) study, Christie and Jankensgård (2021) did not find any reliable indicator that leverage should be resilient to revenue shocks in their study. However, they argued that leverage should not be seen as dangerous, their study simply shows that leverage is not a dominating factor for absorbing revenue shocks. Christie and Jankensgård (2021) used employment as a proxy in their paper, thus other proxies might have other results (e.g., Investments). Contrary, Chava, and Robert (2008) find that firms with more debt may instead make cuts in investment spending in order to adjust to revenue shocks, as violations of debt covenants (or a high risk thereof) frequently limit firms' ability to uphold investment spending. We tests the hypothesis below in this thesis:

Hypothesis 1: The negative impact of the COVID-19 pandemic on the number of people employed by airlines decreases with lower amounts of leverage.

Hypothesis 2: The negative impact of the COVID-19 pandemic on investments undertaken by airlines decreases with lower amounts of leverage.

4.3.2 Cash Margins

A high cash margin can absorb and reduce the impact of revenue shocks. The higher the company's cash margin, the more of a shortfall in revenue the company can sustain. A high cash margin can be seen as a buffer to help companies fulfill their commitments without making costly adjustments. However, as cash margin is a pre-capital expenditure, it is likely that investment spending would decrease in response to revenue shocks (Fazzari et al., 1988).

Christie and Jankensgård (2021) also found evidence that a high cash margin could help companies to absorb and reduce the impact of revenue shocks. However, the results were not as dominating as the results from the cash reserves. Based on this analysis, we hypothesized that:

Hypothesis 3: The negative impact of the COVID-19 pandemic on the number of people employed by airlines decreases with higher amounts of cash margins.

Hypothesis 4: The negative impact of the COVID-19 pandemic on investments undertaken by airlines decreases with higher amounts of cash margins.

4.3.3 Cash Reserves

Another way of reducing the impact and absorbing the losses caused by revenue shocks is to have a buffer of liquidity such as cash. Cash reserves can help companies to fulfill their commitment without being forced to make costly adjustments. Opler et al. (1999) argue that companies often motivate their cash holding as a precautionary saving that is beneficial in times when revenue decreases.

Christie and Jankensgård (2021) study indicate that cash reserves stand out in terms of absorbing and reducing the impact of revenue shocks. In terms of employee downsizing sensitivity to revenue shocks, cash reserves and liquidity-based resources have been indicated to be the dominating risk capital when it comes to absorbing revenue shocks. Therefore we assume:

Hypothesis 5: The negative impact of the COVID-19 pandemic on the number of people employed by airlines decreases with higher amounts of cash reserves.

Hypothesis 6: The negative impact of the COVID-19 pandemic on investments undertaken by airlines decreases with higher amounts of cash reserves.

4.3.4 Operating flexibility

One of the general strategies of managing risk is the ability to adapt and reduce costs when revenue decreases. The operating flexibility can be defined as the company's ability to scale its operations up or down in response to the demand without any adjustment cost. According to Mandelker and Rhee (1984) the risk and the operating leverage increases when a company's cost structure is made up with a high degree of fixed cost. Contrary, less fixed cost and a higher degree of operating flexibility decreases the risk. Thus, it is likely that companies that can scale their cost of sold goods in relation to the demand would be more likely to absorb and reduce the impact of revenue shocks.

In Christie and Jankensgårds (2021) no evidence of that operating flexibility would help to absorb and reduce the impact of a revenue shock. This is contrary to what Mandelker and Rhee (1984) found in their study. As employees were used as a proxy in Christie and Jankensgårds, other proxies might find other evidence.

Hypothesis 7: The negative impact of the COVID-19 pandemic on the number of people employed by airlines decreases with higher amounts of operating flexibility.

Hypothesis 8: The negative impact of the COVID-19 pandemic on investments undertaken by airlines decreases with higher amounts of operating flexibility.

5. Methodology

In this chapter, the methodology applied in this thesis is described. Section 5.1 describes the sample selection. Section 5.2 describes the empirical design applied, and section 5.3 describes the variables used in this thesis.

5.1 Sample selection

The paper used financial data of listed airlines from the year 2016-2019 to estimate trends in the data and the year 2020 to measure the effect of the COVID-19 pandemic. Refinitiv Business Classification is used to identify the firms analysed in the study. The firms are all part of the industry airlines and the activity Airlines (NEC). Further, only publicly listed airlines are included due to the reporting requirement put on these firms. The initial sample includes 97 airlines from around the globe. However, 2 airlines were removed from the sample due to being under reconstruction and three airlines were removed due to having below 100 employees. Moreover, 12 airlines were removed from the sample due to incomplete financial information over the time period, primarily regarding the number of employees. The remaining sample consists of 80 airlines and 399 firm years. Financial numbers and ratios for each airline included are obtained from Thomson Refinitiv Eikon.

5.2 Empirical design

In order to test the hypothesis described previously, multivariate regression is applied to estimate if risk capital mitigates the negative effect of the COVID-19 pandemic on employees and investments. The first model (Eq. 1) intends to measure the effect on employees with the dependent variable log of employees. The second model (Eq. 2) measures the effect on investments and the ratio between capex and PPE is used as a proxy for it. The right-hand side of the models includes the four risk capital variables, and two control variables that are thought to have the potential to be systematically related to the dependent variables.

Equation 1

$$log\ (Employees)_{\ it} = \beta_0 + \beta_1 OPflex_{it} + \beta_2 Cashmargin_{it} + \beta_3 Cashreserves_{it} + \beta_4 Equityratio_{it} + \beta_6 Size_{it} + \beta_7 Markettobook_{it} + u_{it}$$

Equation 2

$$\log(Capex)_{it} = \beta_0 + \beta_1 OPflex_{it} + \beta_2 Cashmargin_{it} + \beta_3 Cashreserves_{it} + \beta_2 Cashmargin_{it} + \beta_4 Equityratio_{it} + \beta_6 Size_{it} + \beta_7 Markettobook_{it} + u_{it}$$

In order to test the hypothesis described previously, the interaction variable *2020* is introduced to models three and four. This makes us able to capture the effect of the Covid-19 pandemic with the following models:

Equation 3

$$log\ (Employees)_{it} = \beta_0 + \beta_1\ 2020_i + \beta_2 OPflex_{it} + \beta_3 Cashmargin_{it} + \beta_4 Cashreserves_{it} + \beta_5 Equityratio_{it} + \beta_6\ 2020_i * OPflex_{it} + \beta_7\ 2020_i * Cashmargin_{it} + \beta_8\ 2020_i * Cashreserves_{it} + \beta_9\ 2020_i * Equityratio_{it} + \beta_{10} Size_{it} + \beta_{11} Markettobook_{it} + u_{it}$$

Equation 4

$$\log(Capex)_{it} = \beta_0 + \beta_1\ 2020_i + \beta_2 OPflex_{it} + \beta_3 Cashmargin_{it} + \beta_4 Cashreserves_{it} + \beta_5 Equityratio_{it} + \beta_6\ 2020_i * OPflex_{it} + \beta_7\ 2020_i * Cashmargin_{it} + \beta_8\ 2020_i * Cashreserves_{it} + \beta_9\ 2020_i * Equityratio_{it} + \beta_{10} Size_{it} + \beta_{11} Markettobook_{it} + u_{it}$$

2020 is a dummy variable that takes the value 1 if the firm-year is 2020 and 0 if it is any other year. The coefficient $\boldsymbol{\beta}1$, therefore, measures how capex and employees were affected by the treatment effect that was the COVID-19 pandemic. With 4 interactions applied in the same model, there is a risk for a weaker significance value due to the limited sample size of airlines in the study. Therefore, each risk capital will first separately be interacted with the y2020-dummy in individual models. If the coefficient *2020 x OPflex* is positive, it indicates that operating flexibility had a positive impact during the shock caused by COVID-19. This study aims to research risk capital's ex-ante effect, so all risk capital is fixed to pre-pandemic levels in 2019 due to airlines' logical reaction to utilize their risk buffers to shield themselves against the impact. Some regions experienced the outbreak of COVID-19 earlier than others and policy changes regarding employees and investments can take time to implement. Therefore, the

end-the-year difference between 2019 and 2020 is analysed since that gives the consequences of the impact on the airlines sufficient time to materialize.

To further isolate the effect of the pandemic, a difference-in-difference approach would have helped since it measures the difference between a treated group of firms and the unaffected control group of firms. However, all sectors and regions were affected by the pandemic, which makes a control group with similar characteristics to the sample difficult to define. Instead, time-series data going back to 2016 makes it possible to investigate trends that were affecting the dependent variables before the pandemic hit. This does not exclude the possibility that another exogenous shock during 2020 simultaneously affected the dependent variables, but the COVID-19 pandemic reduced the demand for air travel to an extent never experienced before so it is therefore unlikely any other underlying factor caused a major shift. Moreover, the paper's main focus is not on the COVID-19 treatment but rather the interaction between it and the risk capital variables.

5.3 Variable description

5.3.1 Dependent variables

The dependent variable *log(Employees)* is the log value of the number of employees at the airline. A log value is used to normalize the variable since the number of people employed is skewed to the right due to the vast size of a few airlines.

Capex represents capital expenditure/PPE and it is a common proxy for investments in literature (Aggarwal et al., 2006). Capex is funds used by firms to acquire, upgrade and maintain fixed assets. It is scaled by the deflator property, plant, and equipment to account for differences in firm size. While capex is the most commonly used proxy to measure firm investments, there are alternative methods applied in literature like R&D or growth in inventory (Hennessy and Levy, 2002; Gaver and Gaver, 1993; Kashyap, Lamont and Stein, 1994). However, R&D and growth in inventories represent investment opportunities poorly in the majority of industries and especially in the airline industry where these expenses constitute a relatively small share of overall expenses for the airlines (Hsiao and Li, 2012).

5.2.1 Risk capital

The four risk capital variables captured in the model are defined and calculated according to the methodology used by Christie and Jankensgård (2021).

A high degree of Operating flexibility increases companies capability to respond to uncertainty and is measured by COGS/SGA. COGS is the cost of goods sold, while SGA is selling, general, and administrative expenses.

Cash margin can be seen as a buffer to help a company fulfill their commitments without having to make substantial adjustments to the cost structure. Cash margin is calculated as Revenue/(SGA+COGS). A higher margin would, in theory act like a buffer that can help absorb and mitigate revenue shocks. Cash reserves represent funds that firms are able to use in case of emergency situations. It is defined here as cash and cash equivalents divided by total assets (CHE/AT).

The final risk capital variable is equity ratio and it indicates how much of a company's assets have been generated by issuing equity shares rather than by taking on debt. The formula is one minus total liabilities divided by total assets (1-LT/AT). A negative coefficient or an overall lack of significance in any of these variables would suggest that risk capital does not sufficiently mitigate the negative impact of the COVID-19 pandemic on employees or investments.

5.2.2 Control variables

Further control variables are added that have the potential to be systematically related to the dependent variables. Taleb (2012) explores the impact of major unpredictable events and claims that size is conductive to fragility. In the context of this study, it implies that the sensitivity of investments and employees during revenue shocks, increases as a function of size. Shen et al. (2020) further use size as a control variable when measuring the impact of the covid-19 pandemic on firm performance. They find that size mitigates the negative effect of the pandemic on investments. This paper applies the same control variable Size and it represents the log value of a firm's total assets.

Market-to-book value is another common control variable when analyzing firm performance. The Market-to-book ratio is included since it could impact investment possibilities and employees of each firm since it is a determinant of financing decisions (Frank and Goyal, 2009). High growth opportunities imply the firm has less assets in place and, therefore higher financial distress costs which could lower the rate of investments and hiring of necessary employees. The variable Market-to-book is the ratio of market value of assets to book value of assets.

6. Data summary

In this chapter, the descriptive statistics of the variables are presented.

When aggregating the observations in the final sample for the period 2016 to 2020, 399 observations remain. The majority of the observations are in Asia, North America, and Europe, in which Asia constitutes 41 percent, North America 25 percent, and Europe 23.75 percent of the total observations. The remaining continents Oceania, South America, and Africa, only constitute 10 percent of the observations combined. In table 1 the firm's continent of incorporation is displayed.

Table 1. The geographic location of airlines in the sample

Continents	**Number of Airlines**
Asia	33
North America	20
Europe	19
Oceania	4
South America	3
Africa	1

In table 2 it can be observed that there is a large difference in the number of employees between the observed firms over the time period. The average number of people employed by the airlines is 21,655, with a standard deviation of 9,211. The substantially higher median at 29,797 suggests a few very large airlines skew the data to the right with the highest observation being 138,353 employees. The investment rate also differs a lot with the mean of Capex being 14% and a standard deviation of 13.1%. Based on the Minimum value of Capex this indicates there was at least one airline barely engaging in any investments during the time period. The average liquidity of the airlines over the period can be seen in the variable cash margin with a mean of 117% and cash reserves of 11%. The final risk capital is equity ratio and a mean of only 24.2% equity indicates that the airline industry as a whole is highly leveraged.

Table 2. Summary statistics

Statistic	N	Mean	St. Dev.	Median	Max	Min
Employees	399	21,655	9,211	29,797	138,353	117
Capex	399	0.140	0.131	0.120	0.990	0.001
Opflex	399	6.414	7.189	3.526	45.875	0.331
Cash Margin	399	1.171	0.234	1.152	1.682	0.059
Cash Reserves	399	0.109	0.106	0.071	0.500	0.001
Equity ratio	399	0.242	0.287	0.240	0.764	0.012
Market to book	399	2.530	3.530	1.682	12.333	-2.236
Log (size)	399	9.886	2.569	9.863	18.385	2.773

Figure 1 displays trendlines over the average end-of-year reported capex ratio for the airlines. Trendlines for Africa, Oceania, and South America are not included since each region has 4 or fewer airlines which would heavily distort the average. Throughout the period 2016-2019 capex remains stable at around 15%, so no parallel trend can be identified. The black vertical line indicates when the pandemic hit at the end of 2019 and capex fell to 11.2% the following year at the end of 2020. Between the different regions, capex varied a lot with North American airlines spending more throughout all periods while European airlines had lower than average capex. Asia remained close to the average over the time-period and made the least cuts to capex after the pandemic hit.

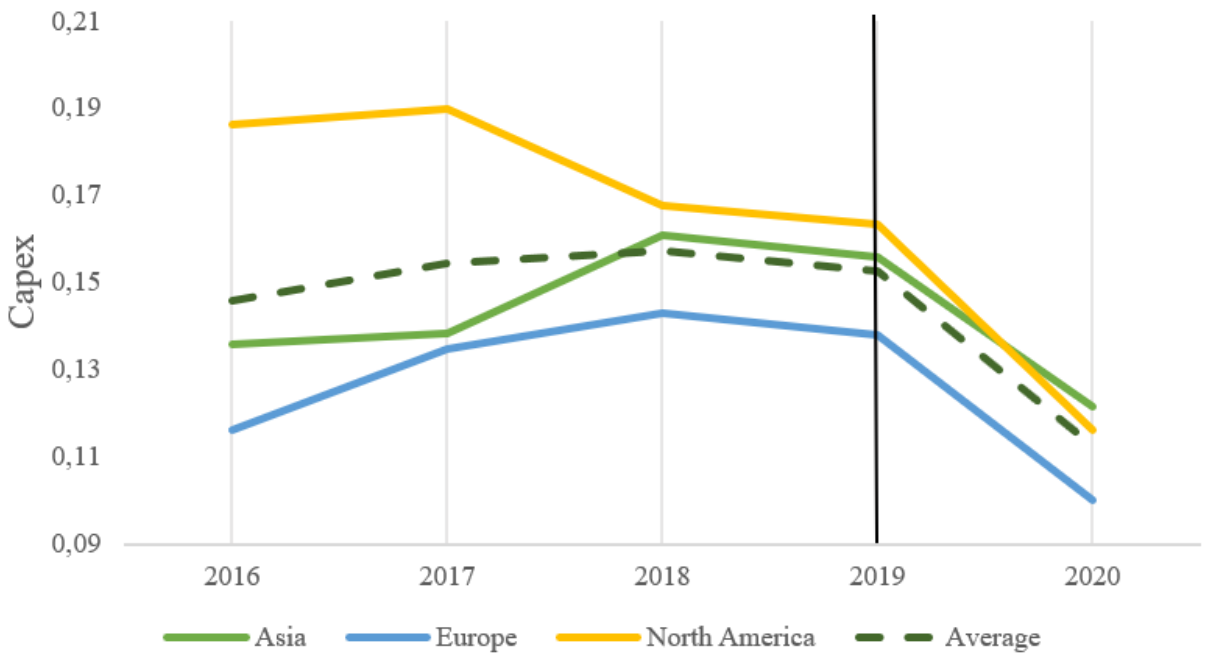

Figure 1. Trend lines over the end-of-year reported average capex/PPE in the airline industry as a whole and in the three continents Asia, Europe, and North America. The black line represents when the COVID-19 pandemic hit at the end of 2019.

Figure 2 shows trend lines over employees and there is a clear upwards trend between 2016-2019. This indicated the sector experienced steady growth over the period which makes the drop in employees after 2019 more significant. Between the years 2019 and 2020 the average number of people employed by an individual airline dropped by 3661. North American airlines were vastly larger in size compared to their Asian and European counterparts but North American airlines also suffered the largest loss of employees during the pandemic, both in absolute term and relative in %. Similar to figure 1, Asian airlines experienced the lowest reductions after the pandemic hit, with employees not reaching below 2016 levels.

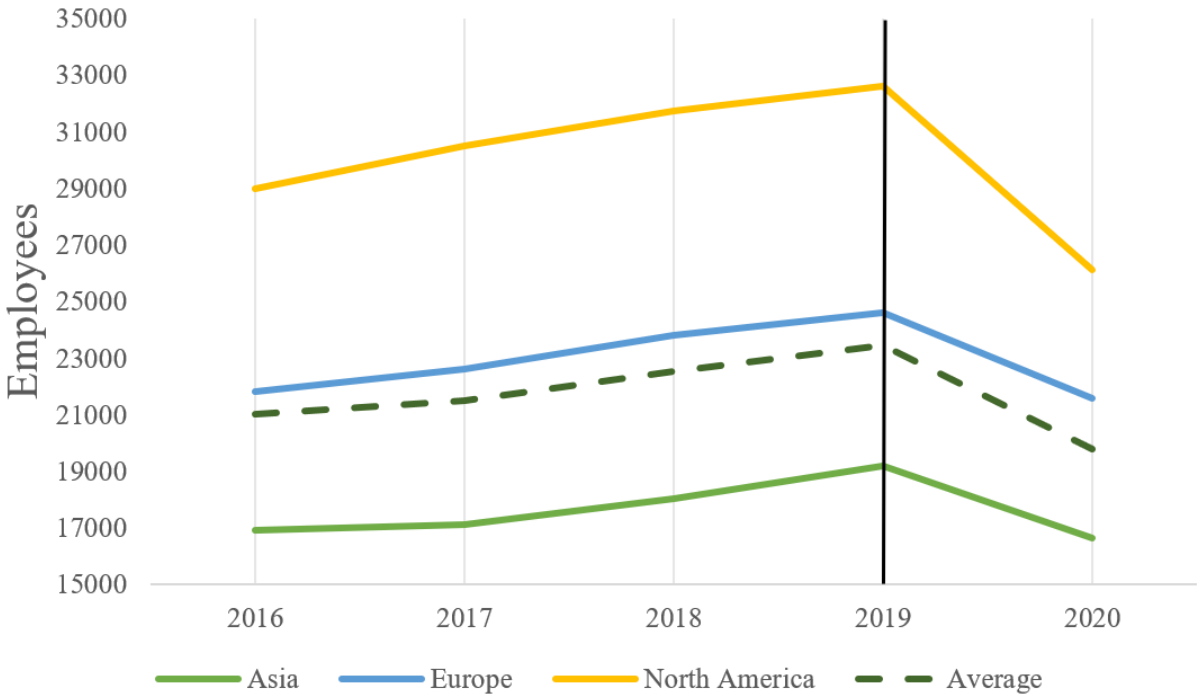

Figure 2. Trend lines over the end-of-year reported average numbers of employees in the airline industry as a whole and in the three continents Asia, Europe, and North America. The black line represents when the COVID-19 pandemic hit at the end of 2019.

7. Empirical Findings

In this chapter, the empirical findings are presented. Section 7.1 presents the variable correlations. Section 7.2 presents the results from the regression.

7.1 Variable Collinearity

A key assumption behind OLS regression is that there is no perfect collinearity between the dependent and independent variables. No variable in Table 3 displays high enough correlation to cause concern which implies the independent variable does not coincide with a change in a variable with which it is correlated with. The highest correlation is between Log(employees) and Log (size) at 0.50, which is not surprising considering the number of employees is occasionally used as a proxy for size.

Table 3: Correlations matrix

	Log(capex)	*Log(employees)*	*Opflex*	*Cash Margin*	*Cash Reserves*	*Equity Ratio*	*Market to book*	*Log(size)*
Log(capex)	1							
Log(employees)	-0.03	1						
Opflex	0.15	-0.29	1					
Cash Margin	0.07	0.26	-0.13	1				
Cash Reserves	0.21	-0.30	0.21	-0.01	1			
Equity Ratio	0.11	-0.13	0.17	0.19	0.23	1		
Market to book	0.06	-0.09	0.19	-0.04	0.04	0.03	1	
Log(size)	-0.01	0.50	0.14	-0.08	-0.28	-0.19	0.03	1

7.2 Regression Results

In this section, we apply a multivariate regression to analyze the impact of the COVID-19 pandemic on capex and employees in the airline industry. The base equations 1 and 2 are used in table 4, with risk capital and control variables being independent variables. The main variable of interest is in the sensitivity of Log(capex) and Log(employees) and to the dummy variable y2020, which indicates it is the year 2020 when the pandemic hit. Model 1 indicates that on average, holding all other factors affecting capex constant, the COVID-19 pandemic decreased end-of-year capital expenditure ratio with 41,5%. This implies the negative revenue shock experienced during the COVID-19 pandemic caused airlines to invest less. This negative effect can be witnessed in model 2 as well. The COVID-19 pandemic reduced end-of-year employment in 2020 by an average of 26.8% among all airlines, holding all other variables constant. Moreover, it can be concluded that the negative impact caused by the

COVID-19 pandemic was more statistically significant for investing with a p-value below 1%, compared to below 5% for employees.

Table 3: Baseline regressions

Dependent variable	log(capex) Model 1	log(employees) Model 2
y2020	-0.415***	-0.268**
	(0.066)	(0.184)
Opflex	0.002***	0.056***
	(0.001)	(0.009)
Cash Margin	0.041***	1.415***
	(0.037)	(0.013)
Cash reserves	0.278***	-1.323**
	(0.064)	(0.023)
Equity ratio	0.024***	-0.021**
	(0.023)	(0.211)
Markettobook	-0.003	-0.017
	(0.016)	(0.016)
log_size	0.021	0.313***
	(0.023)	(0.024)
Observations	399	399
R-squared	0.176	0.146

Tabel reports results from both Equations 1 and 2 where the dependent variables are the logarithmic value of capex divided by PPE and log value of number of employees. The dummy variable y2020 takes the value 1 if it is when the COVID-19 pandemic hit in the year 2020, zero all other years. Significance levels of 10%, 5%, and 1% are denoted by *,**, and ***, respectively.

We expand on the previous models in table 4 by interacting the COVID-19 variable y2020 with the four risk capitals according to Equations 3 and 4. Table 4 displays the effect on Log(capex) with each risk capital at first separately interacted with y2020 (model 3-6) and finally, all interaction variables are included (Model 7). After introducing the interaction variables, y2020 still has a negative coefficient and is still highly statistically significant. The results further suggest that both cash reserves and equity ratio are the most important financial buffers to mitigate the negative impact COVID-19 has on airlines' investments. In Model 5 and the main model 7, the regression coefficient of the variable y2020 * Cash reserves is 0.307, which is significant at the 5% level. This supports Hypotheis 6 that liquidity such as cash effectively can absorb potential losses caused by revenue shocks and prevents cuts to capital expenditure. The coefficient of y2020 * Equity ratio is also positive and highly significant at 1%. This supports hypothesis 2 that the capital structure of airlines and the decision to finance assets through

equity proves to be an effective way to reduce airlines' need to reduce capex during economic downturns. Model 3 shows that operating flexibility also might be an effective risk capital but the weak significance of 10% drops in the main model 7. We can therefore not draw any strong conclusions that the ability to adapt and reduce costs quickly during revenue falls helps airlines to keep up their capital expenditure. Lastly, cash margin lacks significance in both Model 4 and Model 7 which indicates it lacks the ability to moderate revenue shortfalls.

Table 4: Regressions capex

	Dependent variable = Capex				
	Model 1	Model 2	Model 3	Model 4	Model 5
y2020	-0.042***	-0.048**	-0.060**	-0.046***	-0.036***
	(0.021)	(0.066)	(0.024)	(0.021)	(0.041)
Opflex	0.002***	0.002***	0.002***	0.001***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Cash Margin	0.030***	0.040***	0.036**	0.019**	0.051***
	(0.028)	(0.037)	(0.029)	(0.028)	(0.039)
Cash reserves	0.271***	0.268***	0.332***	0.259***	0.329***
	(0.063)	(0.064)	(0.071)	(0.063)	(0.072)
Equity ratio	0.025***	0.024***	0.027***	0.045***	0.027**
	(0.023)	(0.023)	(0.023)	(0.032)	(0.034)
y2020 * Opflex	0.004*				0.002
	(0.002)				(0.002)
y2020 * Cash Margin		-0.042			-0.023
		(0.056)			(0.059)
y2020* Cash reserves			0.227**		0.207**
			(0.064)		(0.067)
y2020 * Equity ratio				0.107***	0.091**
				(0.043)	(0.046)
Markettobook	0.001	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Log(size)	0.003	0.003	0.003	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	399	399	399	399	399
R-squared	0.158	0.153	0.162	0.153	0.165

Tabel reports result from Equation 4 with each risk capital interacted with the dummy y2020. The dependent variable in all models is the log value of capex divided by PPE. The dummy variable y2020 takes the value 1 if it is when the COVID-19 pandemic hit in the year 2020, zero all other years. Standard errors in parentheses and a significance level of 10%, 5%, and 1% are denoted by *,**, and ***, respectively.

The models in Table 5 are similar to the ones in Table 4 except for the dependent variable that is swapped out for Log(employees). The only risk capital that helped mitigate the negative impact of

COVID-19 on employees was Cash reserves. In Model 10 and 12, the regression coefficient of the variable y2020 * Cash reserves is 0.308 and highly significant at the 1% level which supports hypothesis 5. This also follows Christine and Jankensgård (2021) findings that cash reserves stand out in terms of absorbing the impact of revenue shocks and their negative consequences on the number of employees. However, Unlike Christine and Jankensgård (2021) paper, cash margin did not show any positive effect on employment during shortfalls since the coefficient lacks significance in models 9 and 12. Tabel 5 further suggests that operating flexibility and equity ratio also lacks effectiveness as a buffer against employee downsizing.

Tabel 5: Regression employees

	Dependent variable = log(employee)				
	Model 6	Model 7	Model 8	Model 9	Model 10
y2020	-0.246**	-0.266**	-0.359**	-0.330*	-0.335
	(0.194)	(0.184)	(0.208)	(0.172)	(0.209)
Opflex	0.070***	0.066***	0.066***	0.063***	0.068***
	(0.010)	(0.009)	(0.009)	(0.008)	(0.010)
Cash Margin	1.595***	1.425***	1.545***	1.686***	1.497***
	(0.012)	(0.013)	(0.012)	(0.012)	(0.013)
Cash reserves	-1.263**	-1.293**	-1.729***	-1.173**	-1.487**
	(0.021)	(0.023)	(0.023)	(0.022)	(0.024)
Equity ratio	-0.036***	-0.021**	-0.054**	-0.559*	-0.433**
	(0.210)	(0.211)	(0.210)	(0.293)	(0.305)
y2020 * Opflex	0.025				0.018
	(0.012)				(0.022)
y2020 * Cash Margin_		0.513			0.059
		(0.017)			(0.021)
y2020* Cash reserves			0.308***		0.324***
			(0.033)		(0.041)
y2020 * Equity ratio				0.298	0.189
				(0.394)	(0.422)
Markettobook	-0.014	-0.017	-0.015	-0.017	-0.017
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Log(size)	0.315***	0.312***	0.312***	0.308***	0.320***
	(0.024)	(0.024)	(0.024)	(0.023)	(0.024)
Observations	399	399	399	399	399
R-squared	0.156	0.156	0.159	0.163	0.171

Tabel reports result from Equation 3 with each risk capital interacted with the dummy y2020. The dependent variable in all 5 models is the logarithmic value of the number of employees. The dummy variable y2020 takes the value 1 if it is when the COVID-19 pandemic hit in the year 2020, zero all other years. Standard errors in parentheses and a significance level of 10%, 5%, and 1% are denoted by *,**, and ***, respectively.

8. Conclusions and Further Research

In this chapter, the conclusions of the thesis are presented and suggestions on further research are presented.

This paper focuses on comprehensively discussing risk capital's ability to mitigate the revenue shock caused by the COVID-19 pandemic on the airline industry. The results indicate that company investments were sensitive to the shock, with airlines' capital expenditure ratio decreasing as a consequence with 41,5%. When measuring the consequence on employment, it experienced a similar negative trend with a 26.8% cut to the number of people employed by the airlines. The source of risk capital that proved most effective at absorbing this negative shock on the industry was liquidity in the form of cash reserves which mitigated both the reduction in investments and employees. Moreover, economic capital also showed to be an effective buffer demonstrated by the higher equity ratio's ability to defend airlines' investment rates.

The COVID-19 pandemic created a global recession which caused large economic losses for global aviation. Mitchell and Mullherin (1996) claim that industry shocks forcing financially weak firms to file for bankruptcy or consider being acquired proved to be correct with liquidation and bankruptcy of several airlines taking place during 2020. The airline industry had experienced several consecutive years of sector growth displayed by the increase in employees but government bans on international flights in 2020 were definitely detrimental. The airline industry is also extra exposed to the contagion effect proposed by Lang and Stulz, 1992 making it very sensitive to negative shocks due to the high leverage used in the sector. The fact that the reduction of firm investments was more statistically significant in all regression models than employees strengthens Fazzari et al. (1988) claim that an accurate way to measure financial constraints is to infer it from differences in observed investment sensitivity. However, the number of people employed by airlines had been growing steadily between 2016-2019 and that structural growth might have impacted the outcome in 2020. At the same time, the reduction of employees far exceeded Christie and Jankensgård (2021) findings of an average reduction in employees of 14,8% during negative shocks. Despite generous government subsidies to the industry, the phenomenon of labour hoarding proposed by Leslie and Laing (1978) seem to have had limited effect, and airlines instead estimated the costs related to future hiring and training of employees when the economy picks back up was worth bearing.

Nocco and Stulz (2006) argue that economic capital, namely equity capital, can be used as a buffer to ensure the firm's survival during revenue shocks. The empirical findings of this thesis suggest that the

capital structure of airlines and the decision to finance assets with equity is an efficient way to mitigate the need to reduce capex. This is consistent with Stulz (1996) arguments that the capital structure helps a company absorb and reduce the impact of revenue shocks. Higher leverage firms have more cash commitments which increase the risk of bankruptcy. However, contrary to the effect on capex, the empirical findings suggest equity ratio lacks effectiveness as a buffer against employee downsizing. This complements Christie and Jankensgård (2021), results which also did not find reliable indication that low leverage is resilient to employee downsizing. The difference in empirical data between employees and investments can be connected to Cava and Roberts' (2008) argument that firms with higher debt are more keen to make cuts in investment spending to adjust to revenue shocks.

According to Fazzari et al., (1988) a high cash margin can, similar to cash reserve, reduce the impact of revenue shocks and help firms to fulfill their commitments without doing costly adjustments. However, they also argue that it is not likely that cash margin would have any effect against cuts in investment spendings. Similarly to Fazzari et al., (1988) result, the empirical findings on cash margin in this thesis lack significance. This complements Fazzari et al., (1988) discovery that cash margin lacks an effect against cuts in investment spendings. Christie and Jankensgård (2021) found limited evidence that cash margin would be efficient against employee downsizing. However, the empirical findings in this paper do not find evidence that cash margin has a positive effect on employment during revenue shocks. The different result can be as this study is conducted on more recent data and that the observation in this study is industry-specific.

It is also argued that cash reserves can help companies to fulfill their commitment without making costly adjustments. Opler et al (1999) argue that one of the most used arguments for firms with large cash holdings is that it is a precautionary saving. Christie and Jankensgård (2021) result indicated that cash reserves did stand out in terms of absorbing revenue shocks. Similarly, the empirical findings of this study have suggested that cash reserves stand out in terms of absorbing the impact of revenue shocks and their negative consequences on the number of employees and cuts in investments. This complements Christie and Jankensgård (2021) as cash reserves stand out as the most efficient risk-capital against cuts in investment spendings as well. Christie and Jankensgård (2021) concluded in their paper that “cash is the king” and the results from this thesis show that this sentiment is true within the airline industry as well.

Mandelker and Rhee (1984) found that companies with high operating flexibility are more likely to sustain revenue shocks. However, Christie and Jankensgård (2021) found no evidence that operating

flexibility would reduce the impact of revenue shocks in terms of employee downsizing. Similarly, the empirical findings in this thesis suggested operating flexibility lacks effectiveness as a buffer against employee downsizing. However, limited support is found for operating flexibility to be an effective risk capital in terms of cuts in investment spendings, but these indications are rather weak and operating flexibility should therefore not be considered as effective.

8.1 Further Research

Going forward, it would be an important addition to the results found in this paper to research what type of firms priorities cutting capex over employees in response to revenue shocks. Firms with high leverage could be inclined to reduce capex spending in order to survive in the short term and pay off debt commitments. Therefore examining sectors with less leverage than airlines might yield different results. If the owner instead has a lot of capital to invest in the firm, the strategy might be to prioritize keeping capex up in order to continue with expansion objectives. Firms where a large number of employees are unionized might be less inclined to pursue costly large layoffs and the phenomenon of labor hoarding would therefore be more present.

In future research, with the use of the larger dataset, more robust conclusions related to the risk capital could possibly be made. For example, operating flexibility has a weak positive relation to investments in one of the models but further research is needed in order to draw any robust conclusions. It would also be interesting to do a similar empirical study at a later point to see if the negative impact from the COVID-19 remains or if investments and employees bounced back in 2021.

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