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Market Power and Multimarket Contact – Implications of a recent merger between a Network Legacy Carrier and a Low-Cost Carrier in the U.S.

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The introduction of the U.S. Deregulation Act of 1978 initiated a global trend towards consolidating activities within the airline industry. This change in the competitive landscape was initiated by the introduction of free market mechanisms, which led to lower airfares, an increase in the number of flights and passengers carried, a series of airline mergers and the emergence of the Low-Cost Carrier business model. Consequently, there are intense debates within the industry about the extent to which mergers have pro- or anticompetitive effects on airfares and competitive behaviors and how the direction of airfare changes is affected by two forces related to a merger, which are increased market power and efficiency gains. The following study examines the effects on airfares of a merger between a Network Legacy Carrier and a Low-Cost Carrier in the United States, considered as one of the first of its kind and hence the findings could provide important insights into discussions regarding government approval of similar mergers in the future. The estimation results of a difference-in-differences regression analysis suggest that the merger led to anticompetitive effects on consumers, driven by the merged entity, on the affected, overlapping, and non-overlapping routes, in particular on routes where only Alaska Airlines operated prior to the merger without the other merging carrier being present, due to significant increases in airfares. Furthermore, this anticompetitive effect is associated to a longer period and is therefore not a short-term effect present on the affected routes which may be associated to tacit collusion due to the multimarket contact present in the industry.

Keywords: Airline Mergers, Airline Competition, Merger Retrospective, Multimarket Contact

Table of Contents

1. INTRODUCTION 1

2. THEORETICAL BACKGROUND 4

2.1 Literature Review 5

2.2 Industry Background 10

2.3 Airline Business Models 12

2.3.1 Characteristics of the NLC model 13

2.3.2 Characteristics of the LCC model 14

2.4 Carriers 15

2.4.1 Characteristics of Alaska Airlines 17

2.4.2 Characteristics of Virgin America 18

3. DATA AND METHODOLOGY 19

3.1 Empirical Method 19

3.2 Data 20

3.2.1 Construction of the final dataset, descriptive and summary statistics 21

3.3 Empirical Regression 24

3.3.1 Model specification 25

3.3.2 Evaluation of DID estimation assumptions 27

4. ESTIMATION RESULTS 30

4.1 Regression - First Hypothesis 31

4.2 Regression - Second Hypothesis 37

4.3 Robustness Check 41

5. DISCUSSION AND CONCLUSION 45

5.1 Discussion 45

5.2 Conclusion 49

APPENDIX 52

BIBLIOGRAPHY 69

1. Introduction

Since the U.S. Airline Deregulation Act of 1978, which abolished the government regulation of the industry by the Civil Aeronautics Board (CAB), such as control of airline entry and exit, price floors on airfares, and regulation of frequency of service, with the intent of stabilizing the airline industry to facilitate technological and economic growth, the airline industry has undergone significant changes (Brown, 2014), (Goetz & Vowles, 2009). This legislation initiated a global political trend towards neo-liberal economic policies based on the concept of perfect competition, which emerged in the late 1970s and led to the introduction of free market mechanisms that resulted in a decrease in airfares and an increase in the number of flights and passengers carried, and launched the rise of the Low-Cost Carrier (LCC) business model in the United States (U.S.) through the expansion of carriers such as Southwest Airlines (Francis, Humphreys, Ison, & Aicken, 2006), (Bachwich & Wittman, 2016), (Barrows, 2018). As a result, several airline mergers took place due to the consolidation of the industry changing the competitive structure and leading to intense debates within the industry as to which extent mergers lead to pro- or anticompetitive effects on airfares and competition in the industry (Goetz & Vowles, 2009), (Baker, 2013). The following study has the aim to analyze the impact on airfares of the merger between two U.S. carriers, Alaska Airlines (AS) and Virgin America (VX), which at the time of the merger operated different business models. The merger took place in 2016, with the announcement of the deal on April 4th which led to a single operating certificate for the merged entity at the beginning of 2018 (Alaska Airlines - Virgin America, 2016). Alaska Airlines operated as a Network Legacy Carrier (NLC), which is based on a Hub and Spoke network (H&S) that connected hubs with small feeder aircraft in the Pacific Northwest region of the U.S. and Alaska, offering flights to multiple destinations within and outside the United States. Virgin America, instead, operated as an LCC with a primary focus on providing low-fare point-to-point services between major markets on the west coast of the U.S. and other large metropolitan areas. The U.S.

airline industry, and in particular the merger between Alaska and Virgin America, allows for an empirical analysis of the competitive consequences of consolidating activities within the airline industry. The LCCs in the U.S., such as Virgin America or Southwest Airlines, have strongly influenced the development of the airline industry over the past decades due to their lower unit costs, leading to lower airfares in the respective markets compared to the traditional NLCs, such as Delta Air Lines and United Airlines (Bachwich & Wittman, 2016), (Windle & Dresner, 1999). LCCs are able to achieve lower unit costs by adopting a single fleet type strategy, such as Southwest Airlines operating a single Boeing B737 fleet or Virgin America operating a single Airbus A320 fleet, by implementing point-to-point networks without hubs and including secondary airports with high aircraft utilization, by having a shorter turnaround time on the ground, and by generating additional revenue by charging for services that were previously provided for free (Bachwich & Wittman, 2016). These factors mentioned allow LCCs to offer lower airfares to customers while staying profitable compared to airfares charged by traditional NLCs on the same route (Bachwich & Wittman, 2016), (Francis, Humphreys, Ison, & Aicken, 2006). The merger between AS and VX, both operating with a different business model, was one of the first of its kind. Hence the following analysis could provide implications for future industry activities such as how the effects on airfares may differ from NLC mergers in the past, and how these effects may persist, as the number of LCCs continues to grow worldwide, potentially leading to further market consolidation through mergers between LCCs and NLCs. The following study is believed to be the first to examine the implications of a merger between a Network Legacy Carrier and a Low-Cost Carrier on airfares. Furthermore, as the merger took place recently it is an interesting topic to study, and its findings could provide important insights into discussions regarding government approval of similar mergers in the future leading to the following research question:

Research question: *Is a merger between a Network Legacy Carrier and a Low-Cost Carrier pro- or anticompetitive?*

In previous empirical literature, the effects of airline mergers on airfares have varied. However, on average anticompetitive effects through an increase in airfares have been assessed. The effects of a merger on airfares are the result of changes in the market power and efficiency of the resulting firm (Kim & Singal, 1993), (Luo, 2013). While mergers between carriers are expected to lead to efficiencies for the merging firms due to economies of scale and scope, as carriers could benefit by network effects leading to improved service and potentially lower prices, it is important to recognize that the merged firm may also use its increased market power and reduced competition on certain routes to impose higher fares on customers. This could potentially result in a welfare loss, as consumers may experience reduced benefits due to the increase in airfares (Carlton et al., 2017), (Kim & Singal, 1993). Moreover, the reduction in the number of carriers operating in the respective market could also decrease consumers' choice and further strengthen the welfare loss.

To analyze the research question empirically, a difference-in-differences (DID) approach is used as in previous studies such as by Carlton et al. (2017), which allows to compare changes in the average airfare, before (pre-merger period) and after (post-merger period) taking place of the merger on the routes where the merger took place, hence the set of routes where significant competitive effects are expected, defined as the treatment group, compared to routes that have been unaffected by the merger, defined as the control group (Carlton et al., 2017), (Kwoka & Shumilkina, 2010). In this way, the difference in the empirical outcomes in the post-merger period between the routes where the merger took place and the unaffected routes can be attributed to the effects of the merger between the two carriers (Bertrand, Duflo, & Mullainathan, 2004), (Hüschelrath & Müller, 2015). This approach has been used in previous studies evaluating NLC mergers, as seen in Carlton et al. (2017) and Heyer et al. (2009). The empirical results of this study suggest that the merger between a Network Legacy Carrier and a Low-Cost Carrier resulted in an increase of airfares on the routes where the merger took place, and hence had anticompetitive effects on the average airfare on the affected overlapping and the non-overlapping routes. Additionally, this found increase in the average airfare is mainly driven by the merged entity operating under a single brand and operating certificate, suggesting that the increased market power resulting from taking over routes from a competitor outweighs the potential efficiency gains associated with a merger. Surprisingly, the results also suggest that this anticompetitive effect is associated with a longer period and is therefore not a short-term effect on the affected routes and that routes where the NLC Alaska Airlines operated without the other merging carrier present before the merger had a stronger increase in average airfares than on the routes where the LCC Virgin America operated before without Alaska Airlines being present.

The results of a set of alternative specifications based on revised data samples support the main findings confirming the validity of the econometric model used. The findings of this study suggest not only the importance of assessing the competitive effects of a merger by focusing on the two merging carriers, but also that each merger needs to be assessed as an industry-wide dynamic due to the existence of multimarket contacts between the carriers, which may avoid price wars on one route because of fear of retaliation by competitors resulting in higher fares (Edwards, 1955), (Evans & Kessides, 1994), (Kim & Singal, 1993).

The following paper is structured as follows: in Section 2, related literature, some relevant industry background, and the key characteristics of both airline business models which are key as the business models have a big impact on the cost structure of the two entities impacting the airfares offered on the respective routes are assessed. Additionally, the two merging carriers will be shortly described. Section 3 introduces the data used for the empirical analysis and the estimation methodology with its assumptions leading to the empirical analysis of this research. Section 4 presents the estimation results and robustness checks, and Section 5 concludes and discusses whether a merger between an NLC and an LCC has led to a decrease or increase in the average airfare, and thus has pro- or anticompetitive effects.

2. Theoretical Background

2.1 Literature Review

As the airline industry continues to change, one of the critical questions is whether the merger between carriers operating a different business model like an NLC and an LCC network leads to pro- or anticompetitive outcomes. Hence, this study aims to add to the existing empirical research on post-merger evaluations, which will be reviewed in detail in this literature review section. The literature review is a key component of studies, that provides a detailed overview of the current state of knowledge on a respective topic. By synthesizing and analyzing the existing research, the aim is to identify the gaps in the literature and contribute new insights to this field. A major focus will be on the effect on airfares, as previous research has shown that changes in the merging firms' product prices are affected by both increased efficiency and increased market power (Kim & Singal, 1993). Furthermore, as noted by Kim and Singal (1993), any empirical analysis of the competitive effects of a merger should include an analysis of product prices, rather than relying on an empirical analysis based on stock market prices, as previously examined by Eckbo (1983, 1985) and Stillman (1983). In the case of the airline industry, this is feasible as the U.S. Bureau of Transportation Statistics provides datasets containing quarterly information on airfares. A more detailed description regarding the dataset will be provided in Section 3. The direction of airfare changes will serve as an indicator about which of the two forces, which are increased market power and efficiency gains, has a major impact (Kim & Singal, 1993). This tradeoff between the two forces plays an essential role in understanding the competitive effects of a merger in the airline industry as increased market power leads to welfare losses, while efficiency gains would lower the costs and create net welfare gains (Bloningen & Pierce, 2015).

The first force, market power, refers to the ability of a company to set prices higher than the competitive level for an extended period and therefore to generate higher profits. A merger between two companies usually leads to the loss of a direct competitor and leads therefore to higher market share leading to increases in prices and decreases in output with negative effects on consumers (Hüschelrath & Müller, 2015).

The second force, efficiencies, occurs primarily at the operational level of companies, resulting in cost reductions due to economies of scale and scope, reductions in fixed costs, synergies, and the elimination of redundant or overlapping operations (Gugler, Mueller, Yurtoglu, & Zulehner, 2003), (Jain, 2015). Such efficiencies can potentially increase the profitability of the merged entity due to the reduction of marginal costs of production, increased load factors and the consumers could benefit through improved operational services due to a more efficient utilization of the network and lower prices (Hüschelrath & Müller, 2015), (Jain, 2015). According to Luo (2013), airfare effects of a merger between carriers are the result of changes in market power and efficiencies as on the one hand the decreased competition and the increased market power could lead to higher airfares, and on the other hand a merger could lead to efficiency gains which could lead to a decrease in airfares due to an increase in managerial efficiency, synergies and economies of scale or scope (Luo, 2013), (Kim & Singal, 1993). This is confirmed by Kim and Singal (1993), which found that increasing concentration is positively associated with higher fares (Kim & Singal, 1993). The issue of market concentration and its further development is becoming increasingly important due to the ongoing consolidation in recent years and decades, which is leading to a decrease in the number of operating carriers worldwide. This pattern of consolidation begun after the U.S. Airline Deregulation Act in 1978 and continued in the 21st century where in the United States the six major legacy carriers have merged into three as assessed in the study by Carlton et al. (2017) (Carlton et al., 2017). The first empirical research activities about competitive effects of mergers in the airline industry were studied through a detailed post-merger analysis of two legacy airline mergers that took place in the 1980s in the United States: the "Northwest Airlines-Republic Airlines" and the "Trans World Airlines-Ozark Airlines" mergers (Hüschelrath & Müller, 2015). Regarding these mergers Werden et al. (1991) found that the Northwest Airlines (NW) - Republic Airlines (RC) merger resulted in yield (average revenue received per paying passenger flown one mail) increases of about 6% and service reductions of about 24% (Airline Glossary, n.d.). In contrast, the merger of Trans World Airlines (TW) and Ozark Airlines (OZ) resulted in slightly smaller airfare increase by 2% and service reductions by 16% (Werden, Andrew, & Richard, 1991), (Hüschelrath & Müller, 2015). Borenstein (1990) additionally examined the effects of the Northwest Airlines-Republic Airlines and Trans World Airlines-Ozark Airlines mergers on their respective hub airports. He found that the NW-RC merger resulted in an overall price increase of 10%, with a 7% increase if other carriers remained as competitors and a 23% increase if the merger resulted in a monopoly route (Borenstein, 1990), (Hüschelrath & Müller, 2015). When considering the airline industry, it needs to be recognized that each route can be considered a separate market, making it a unique industry (Kim & Singal, 1993). The findings by Borenstein (1990) suggest that mergers affect not only routes served by both carriers prior to the merger, but also routes served by only one of the two merging carriers (Borenstein, 1990), (Hüschelrath & Müller, 2015). This finding is also confirmed in other studies by Kim and Singal (1993) and Kwoka and Shumilkina (2010). Kwoka and Shumilkina (2010) find evidence that airfares increased by about 5% on routes where only one merging airline operated prior to the merger of USAir and Piedmont Airlines in 1987 (Kwoka & Shumilkina, 2010). Kim and Singal (1993) found that significant airfare increases have occurred on routes where the two merging carriers were not competing prior to the merger confirming this finding (Kim & Singal, 1993). It is worth noting that the merger studies discussed here were conducted in the 1980s and early 1990s, as the number of mergers decreased in the 1990s and 2000s but increased again in the 2010s. One of the most extensively analyzed recent mergers is the legacy carrier merger between Delta Air Lines (DL) and Northwest Airlines (NW) in the 2010s, which has been extensively empirically analyzed by Luo (2013), Jain (2015), Hüschelrath and Müller (2015), and Carlton et al. (2017). According to a fixed-effects regression analysis by Hüschelrath and Müller (2015), the merger of Delta Air Lines and Northwest Airlines led to a short-term increase in airfares of around 11% on overlapping routes and 10% on routes where the operating airline changed due to the merger. However, in the long run, increased competition and merger efficiencies reduced airfares, resulting in a final airfare increase of about 3% on the affected routes (Hüschelrath & Müller, 2015). In addition, Luo (2013) finds that, holding all other factors constant, airfares for airport pairs where, both carriers affected by the merger, DL and NW competed before the merger did not increase strongly after the merger. According to Luo (2013) in nonstop markets the impact on airfares is positive with an increase of 5.1%, but statistically insignificant. On the other hand, however in connecting overlap markets the airfare increased by 2.3% holding other things constant and the effect is statistically significant. Luo (2013) argues that this is because the market power effect dominates any possible efficiency gain from the merger in connecting markets (Luo, 2013). The study by Jain (2015) examines the short-term effects of six of the seven U.S. airline mergers that occurred between 2009 and 2012, and therefore includes the merger between Delta Air Lines and Northwest Airlines. The study analyzes airfare data from four quarters before and after the mergers to determine whether they led to higher or lower airfares in the short term and finds that the DL-NW merger increased airfares the most, by about 3-4%, although an increase in airfares can be observed for all observed mergers (Jain, 2015). The studies by Luo (2013), Jain (2015) and Hüschelrath and Müller (2015) are consistent in their empirical findings as all find the evidence of an increase in airfares. However, on the other hand, Carlton et al. (2017) found through a DID regression analysis that legacy carrier mergers that occurred in the 21st century, including the merger of Delta Air Lines and Northwest Airlines, had procompetitive effects and did not significantly affect nominal fares. The study reveals that when considered together, the three mergers led to significant increases in output and insignificant decreases in nominal airfares on nonstop overlap routes where both merging parties operated prior to the merger. Carlton et al. (2017) underlines that this finding remains consistent even when the mergers have been examined separately (Carlton et al., 2017).

Subsection 2.1 shows the debate that has arisen about the impact of airline mergers and whether these mergers have pro- or anticompetitive effects on airfares. On average, the results indicate that airline mergers have been observed to increase the respective airfares. This is the case for the most recent airline mergers but holds as well for the mergers that took place in the 1980s and 1990s. However, when analyzing the effects of an airline merger, it is important to keep in mind that airline mergers may not only increase airfares through the merging carriers, but also, as Kim and Singal (1993) evaluated, tacit collusion plays an important role in the industry, as they find evidence of an increase in airfares by both merging and non-merging carriers, indicating that tacit collusion due to multimarket contact present as carriers compete in different markets, defined as the respective routes, has led to an increase in airfares (Kim & Singal, 1993), (Evans & Kessides, 1994). After discussing the relevant literature on airline mergers, a gap can be observed as all authors focus on Network Legacy Carrier mergers. Thus, most of the recent studies have not evaluated a merger involving a Low-Cost Carrier. This is also mentioned by Carlton et al. (2017), who state that the focus is on legacy airline mergers because they operate a H&S network and are therefore more likely to experience network effects due to mergers. However, the effects of LCC mergers are expected to differ in several dimensions and therefore merit separate analysis (Carlton et al., 2017). Le (2016) analyzed empirically the price and output effects of the merger between Southwest Airlines and AirTran and found the evidence that the elimination of direct competition results in a 3.7% increase in airfares (Le, 2016). The study by Luo (2013) revealed that the impact of changes in LCC competition has a significant impact on fares, while changes in competition from other traditional legacy carriers have only a minor effect (Luo, 2013). As the number of LCCs continues to grow worldwide, as carriers continue to differentiate themselves within the industry, further market consolidation through mergers between LCCs and NLCs can be expected over the coming years, giving high relevance to the first Hypotheses developed below:

Hypothesis 1 (H1): *"The merger between a Network Legacy Carrier and a Low-Cost Carrier leads to an increase in airfares mainly driven by the merged carrier on routes where the merger took place relative to the unaffected routes."*

Additionally, based on the findings of Hüschelrath and Müller (2015) that the effect of a merger on airfares differs from the short to the long run due to the achievement of merger efficiencies in the long-run and the entry of competitors on the affected routes in the post-merger period, which could lead to a decrease in airfares, a second Hypothesis based on Hypothesis 1 is developed and will be evaluated in this study. The Hypothesis is as follows:

Hypothesis 2 (H2): *"The merger between a Network Legacy Carrier and a Low-Cost Carrier leads to an increase in airfares only in the short-, and not in the long-run on routes where the merger took place relative to the unaffected routes."*

To understand the empirical analysis that follows, and the results presented in the study, it is necessary to provide a brief overview of the airline industry and its history. The airline industry has a complex history of mergers, bankruptcies, and government regulations that have influenced the competitive landscape and the pricing and differentiation strategies of individual carriers. Understanding this background is essential when interpreting the study's findings and implications and provides valuable insights into the industry's current and future challenges. Therefore, a brief overview of the industry, beginning with the US Airline Deregulation Act of 1978, is provided in subsection 2.2.

2.2 Industry Background

October 24, 1978, changed the course of the airline industry in the United States and worldwide. On that day, the U.S. Congress approved the U.S. Airline Deregulation Act, which meant that the government, through the CAB, would no longer be involved in regulating the airline industry (Goetz & Vowles, 2009). The CAB was given authority over fares and routes in the 1930s to prevent destructive competition and ensure adequate profits. Over time, however, this has led to a distorted airfare structure that has resulted in fares above efficient levels. The main responsibilities of the CAB were to control the entry of new carriers, as well as entry into new or existing routes. In addition, it also controlled the exit of carriers, resulting in the problem of inefficient carriers remaining in the industry, controlled mergers and inter-carrier agreements, and had the power to provide direct subsidies to specific carriers, resulting in high airfares and low passenger volumes (Goetz & Vowles, 2009), (Moore, 1986), (Crain, 2007). After deregulation, the airline industry experienced several phases of airline entry, beginning with two waves in the late 1970s and early 1990s. Between 1978 and 1983 new carriers entered the market which resulted in a decline in market share for the established airlines (Goetz & Vowles, 2009). In the mid-late 1990s, the second wave occurred with the entry of new carriers additionally to the steady growth of LCC such as Southwest, which led again to a decline in market share for the established larger carriers. However, subsequent airline exits and ongoing consolidation within the industry through mergers and acquisitions have offset the increase in the number of carriers over the past few decades (Goetz & Vowles, 2009). This process was exacerbated by one of the largest downturns in the industry, the terrorist attacks of September 11, 2001, which resulted in a longer period of low demand, heightened security measures and rising fuel costs (Carlton et al., 2017), (Blalock et al., 2007). According to Goetz et al. (2009), this phase of the economic downturn particularly affected established legacy carriers such as Delta Air Lines, Northwest, and United Airlines, while Low-Cost Carriers such as Southwest Airlines remained profitable during this period. For instance, Blalock et al. (2007) studied the impact of the airport security measures implemented after 9/11 due to the attacks on the demand for air travel in the U.S. and found that the passenger volume decreased by approximately 6% on all flights in the U.S. and 9% on flights from the busiest airports in the United States, indicating the magnitude of the negative impact on carriers (Blalock et al., 2007). In the mid-2000s, the number of legacy carriers began to diminish, resulting in only six carriers: American Airlines, Continental, Delta, Northwest, United and US Airways (Goetz & Vowles, 2009). Subsequently, these carriers merged in the late 2000s and early 2010s, leading to the formation of three remaining legacy carriers. These three carriers, which are American Airlines, Delta Air Lines, and United Airlines, still exist today and are currently the largest legacy carriers in the United States (Goetz & Vowles, 2009). In addition, Southwest Airlines, which has steadily increased its market share since the 2000s and carried about 88 million passengers in 2010, acquired AirTran Airways, an LCC, in May 2011, further consolidating the industry (Le, 2016). Following the discussed consolidation of the industry during the 2000s and early 2010s, another relevant merger took place between two prominent U.S. carriers, namely Alaska Airlines and Virgin America, which will empirically analyzed in this study. Finally, and certainly not less important for the industry, the COVID-19 pandemic spread with unprecedented impact at the start of 2020, resulting in a sharp decline in passenger demand, leading to the grounding of two-thirds of the world's aircraft fleet and the cancellation of more than 90% of flights, with international operations even more affected, with 98% of flights cancelled, leading to airline bankruptcies worldwide (Garrow & Virginie, 2021). In 2022 the most recent carrier merger was announced in the U.S., which is planned between JetBlue Airways, a major U.S. Low-Cost Carrier and Spirit Airlines, an American Ultra-Low-Cost Carrier (ULCC) which will further consolidate the industry (jetBlue, 2023).

2.3 Airline Business Models

Although all passenger airlines have the common goal of flying customers from one place to another, it's important to recognize the differences in the product architecture that each airline offers. The airline industry is diverse, with several different business models and operational structures that reflect different approaches to providing air transportation services. Airlines have become sophisticated at market segmentation and product differentiation to meet the needs of different types of demand, resulting in different business models being offered. In their research, Mason and Morrison (2008) found that when comparing carriers, one must be aware of the product architecture, which can be divided into three components: connectivity, convenience, and comfort. Based on these components, carriers try to assess which costs are fixed and which costs can be reduced or even avoided (Mason & Morrison, 2008). Since Alaska Airlines and Virgin America operated two different airline business models, one being a Network Legacy Carrier characterized by a Hub and Spoke structure and a wide range of services offered to customers, and the other being a Low-Cost Carrier based on the use of a point-to-point network and no in-flight services, the differences between the NLC and LCC models will be explained in more detail in the next subsection to provide a brief introduction to both relevant airline business models.

2.3.1 Characteristics of the NLC model

The Network Legacy Carriers, which were established primarily out of national interest, rely on a Hub and Spoke structure with a major concentrations of the operations at a large hub that plays a central role in the carriers' network with a high daily frequency of flights to all destinations served (Cook & Goodwin, 2008). After deregulation in 1978, many airlines adopted the H&S network, where a large number of flights arrive in a short period of time at the hub, which acts as a central connecting point, followed by an equally large number of turnaround departures, allowing passengers to travel from any spoke city to any other destination. In other words, passengers flying from a non-hub destination to another non-hub destination in the network are first flown to the hub, where they board a second flight (Budd & Ison, 2017), (Cook & Goodwin, 2008). The core elements of a network legacy carrier model include the use of major airports, the development of one or more hubs, low aircraft utilization due to the operating model, strong feed and de-feed services to the respective hubs, the offering of frequent flyer programs, passenger lounges, and in-flight services such as complimentary food and beverages. Flights include this quality of service because legacy carriers faced competitive pressures in the early 1990s that made it necessary for the carriers to provide a superior level of service as part of their marketing strategy (Budd & Ison, 2017), (Baker, 2013). In addition, a full range of activities required for a flight at the airport, such as ground handling, catering, and engineering and maintenance (E&M), are carried out in-house. In addition, NLCs operate different types of aircraft in their fleet, such as narrow-bodies and wide-bodies, depending on the route served and its demand, with multiple classes on board (Budd & Ison, 2017), (Baker, 2013). For instance, Alaska Airlines, a Network Legacy Carrier, currently operates a fleet of Airbus A321s and Boeing 737s, as well as the Embraer 175, a short-haul regional aircraft used for its lower-demand feeder network (Alaska Airlines, 2023).

2.3.2 Characteristics of the LCC model

As a result of deregulation in 1978 in the U.S. and later in Europe, new entrants to the airline industry developed a model based on minimizing costs, resulting in low fares offered to consumers. These new entrants were defined as Low-Cost Carriers, which steadily increased their market share throughout the 2000s by streamlining operations, allowing carriers to achieve lower unit costs, and now account for a significant percentage of the global market share, with a market share of around 35% in 2020 (Budd & Ison, 2017), (Statista, 2022), (Bachwich & Wittman, 2016).

Key elements of a Low-Cost Carrier business model are a single-class economy configuration with narrow seat pitch, surcharges for in-flight services such as food and beverages, and the use of a single type of narrow-body aircraft with up to 200 seats on board, such as the Boeing 737 or Airbus A320, with a high utilization rate (11+ hours per day) due to fast and efficient ground times at the airport of around 30 minutes (Budd & Ison, 2017), (Baker, 2013). The LCC business model is primarily based on a point-to-point network in which each route serves a single city-pair, using secondary airports that are less congested and offer lower fares than major airports. LCCs have operational bases where they don't offer transfers or interline services with other carriers, which gives them an advantage in quickly adapting and innovating to changing situations and opportunities (Cook & Goodwin, 2008). In addition, LCCs avoid the use of expensive non-essential terminal facilities, such as direct air bridges or escalators, and often opt for a secondary low-cost terminal, such as the CPH Go terminal in Copenhagen, which is dedicated exclusively to LCCs and where passenger fees are 35% lower than in traditional terminals (Njoya & Niemeier, 2011). In addition, fixed costs are minimized by outsourcing pre-flight activities such as catering, ground handling and E&M (Budd & Ison, 2017). Another key element of a low-cost carrier is that it does not offer frequent flyer programs or passenger lounges at its airports, which further minimizes costs (Baker, 2013).

2.4 Carriers

The merger agreement, which included Alaska Air Group's acquisition of Virgin America for a total transaction value of approximately $4.0 billion, was announced in April 2016. The merger was approved by the U.S. Department of Justice in December 2016, resulting in Virgin America being merged into Alaska Airlines and ceasing to exist as a separate entity, creating the fifth-largest U.S. airline at the beginning of 2018 with a fleet of approximately 280 aircraft, including Virgin America's modern fleet, and a network of more than 1,200 daily flights to more than 115 destinations in the U.S., Canada, Mexico and Costa Rica from hubs in Seattle (SEA), San Francisco (SFO), Los Angeles (LAX), Anchorage (ANC), and Portland (PDX) (Alaska Air Group, 2016). The merger has allowed, according to Alaska Airlines, to expand its network and presence on the west coast and opens up growth opportunities on the east coast, such as the New York and Washington areas, making the combined entity a more competitive carrier in the U.S. market. According to Alaska Air Group, the goal of the merger is to create a combined airline that retains the best aspects of both brands, as the merger brings together highly rewarded airlines in terms of customer satisfaction and industry recognition, as both airlines have consistently ranked at the top of studies and awards for operational performance, safety and customer satisfaction (Alaska Air Group, 2016). The table below provides key information about the two merging carriers including the daily flights operated, the destinations served within the respective network, the fleet, the aircrafts used in the fleet, the employer number, how many customers are served and the hubs of the entities before the merger followed by a subsection that briefly introduces each carrier.

Table 1: Comparison of Alaska Airlines and Virgin America

	Alaska Airlines	Virgin America	Combined
Daily Flights	990	197	1,187
Destinations	116	24	118[1]
Fleet	223	63	286
Employees	15,600	3,200	18,800
Customers	32 million	8 million	40 million
Hubs	ANC, LAX, PDX, SFO, SEA	LAX, SFO	ANC, LAX, PDX, SFO, SEA
Net Income 2015	$848 million	$340.5 million	

Source: Investor Alaska Air Group Inc. (2016) & Transaction fact sheet Alaska Airlines – Virgin America (2016)

Table 2: Domestic market share in % of the 6 largest airlines[2] in the U.S.

	Alaska Airlines	American Airlines	Delta Air Lines	JetBlue Airways	Southwest	United Airlines	Virgin America[3]
2022	4.66	16.01	16.3	4.05	20.34	11.61	
2021	4.54	16.31	15.23	3.77	19.85	9.68	
2020	4.45	16.83	14.37	3.3	19.78	8.92	
2019	5.01	15.49	16.76	4.15	19.47	10.76	
2018	4.88	15.32	16.24	4.35	20.4	11.03	0.26
2017	4.11	15.66	16.26	4.3	20.68	10.83	1.1
2016	4.12	16.16	16.51	4.32	20.62	10.24	1.1
2015	4.06	13.37	16.47	4.13	20.41	9.93	1.00
2014	3.8	9.98	16	3.98	19.06	9.74	0.97

Source: Bureau of Transportation Statistics, T-100 Domestic Market (2023)

[1] Overlap existed between the two carriers
[2] Virgin America is included due to its merger with Alaska Airlines, the 5th largest U.S. airline in 2022
[3] Market share after 2018 is for the combined Alaska Airlines/Virgin America entity

2.4.1 Characteristics of Alaska Airlines

Alaska Airlines, a legacy carrier founded in 1932, is the fifth largest U.S. airline, as shown in Table 2, and prior to the merger served over 100 cities in the United States, Canada, Costa Rica, and Mexico with an average of 990 daily departures. The airline's hub-and-spoke network, as shown in Appendix 1, is based on a strong feeder network and is concentrated on the west coast of the United States, with an important concentration in the Pacific Northwest and Alaska, from where it operates transcontinental and international passenger and cargo flights (Alaska Airlines, 2023).

Prior to the merger, the airline operated as illustrated in Table 1 a fleet of 223 aircraft, including Boeing 737s and regional jets such as the Embraer 175, Bombardier Dash 8 Q400 and Bombardier CRJ-700, and was with 32 million passengers carried the seventh largest U.S. airline in terms of passengers carried. Alaska Airlines operated five hubs in its network - Anchorage, Alaska; Los Angeles; Portland; San Francisco; and Seattle (Alaska Air Group, 2016). According to Alaska, the airline expanded with routes to the East Coast and Midwest and Hawaii and acquired Virgin America in December 2016. Since 2018, the two airlines have operated under a single operating certificate and under the Alaska brand. As common for network legacy carriers, also Alaska offered a frequent-flyer program called “Milaeage Plan” and is member of a strategic airline alliance: the Oneworld Alliance. With 13[4] member airlines including American Airlines, British Airways and Qatar Airways it is the third biggest strategic alliance in the world (oneworld , 2023), (Forbes, 2022). A strategic airline alliance is a voluntary agreement in which carriers combine their efforts and resources to pursue a common business objective while remaining separate entities through the use of code-sharing cooperation, which allows airlines to sell seats on certain flights operated by the partners, with the main goal to reduce transaction costs, eliminating the high mark-up resulting from double marginalization when each airline sells and operates the flight segment separately, share the risks, integrate the networks offering a wider range of destinations to the customers, and

[4] The Russian carrier S7 Airlines has agreed to a suspension of the membership in April 2022 (oneworld, 2023)

giving airlines a marketing advantage by increasing the number of flights listed in computer databases, thereby allowing airlines to gain or maintain market power (Goetz & Shapiro, 2012), (Zuidberg, 2019).

2.4.2 Characteristics of Virgin America

Virgin America, an airline operating under the Virgin brand, was an American low-cost airline based in the San Francisco area that operated from 2007 until 2018, when it merged with Alaska Airlines. Virgin America focused primarily on low-fare, high-quality service between cities on the West Coast with and other major metropolitan areas around the country. The carrier was known for its innovative reputation as it sought to redefine the flying experience for passengers, differentiating itself through modern aircraft, superior in-flight service, competitive airfares, and innovative in-flight amenities such as in-flight Wi-Fi, mood-lit cabins, personalized leather seats, personal video touch screens offering customer entertainment options and on-demand menus, and despite being an LCC, offered its own frequent flyer program (Alaska Air Group, 2016). All these innovative approaches have helped Virgin America win numerous awards, including "Best U.S. Airline" (Alaska Air Group, 2016).

At the time of the merger, which took place in late 2016, as shown in Table 1, Virgin America operated an average of 197 daily flights to 24 destinations in its point-to-point network, as shown in Appendix A1, from its Los Angeles and San Francisco bases with a fleet of 63 Airbus A320 group aircraft, and had, based on Table 2, approximately 1.1% market share in the U.S. domestic market, resulting in 8 million annual customers (Alaska Airlines - Virgin America, 2016).

3. Data and methodology

3.1 Empirical Method

According to Carlton et al. (2017), analyzing the impact of airline mergers on consumers is complex due to the influence of various economic factors on airfares, which can change over time. Hence, the number of competitors on a route is not the only determinant which could lead to an increase or decrease in airfares. This issue poses a challenge when assessing the effects of a merger by examining airfares before and after the merger on the affected routes, as trends in airfares may be incorrectly attributed to the merger if they have different origins (Carlton et al., 2017). To overcome this problem, this study uses the difference-in-differences estimation technique commonly used in previous literature regarding studies of mergers in the airline industry, such as by Carlton et al. (2017) and Heyer et al. (2009). This approach allows to compare changes in the average airfare, before (pre-merger period) and after (post-merger period) taking place of the merger on the routes where the merger took place, hence where significant competitive effects are expected, defined as the treatment group, compared to routes that have been unaffected by the merger, defined as the control group (Carlton et al., 2017), (Kwoka & Shumilkina, 2010). Hence, difference-in-differences regressions, a quasi-experimental method, take a comparative approach to assess the causal impact of an event by contrasting the affected and unaffected groups (Princeton University, 2015). DID allows additionally to control for factors unrelated to the merger, such as economic downturns or jet fuel price increases which could affect airfares, leading to the conclusion that any deviation in the trend of the treatment group relative to the trend of the control group is attributed to the causal effect of the merger between the two carriers. Thus, this approach helps to isolate the effects of mergers by attributing any common changes observed in both groups to factors independent of the merger. When using the difference-in-differences approach, it is critical to meet specific assumptions to obtain unbiased empirical results. The main and most critical assumption is the Parallel Trend Assumption, which states that in the absence of the treatment, the difference between the treated and control groups must remain constant over time. Although there is no statistical test to validate this assumption, visual inspection of the two lines illustrating the trends proves useful (Princeton University, 2015), (Rubiano-Matulevich, 2021). Additionally, the DID analysis also relies on another important assumption known as the Stable Unit Treatment Value Assumption (SUTVA). This assumption states that in a repeated cross-sectional design, the composition of both, the treated and control groups remain unchanged, and that the treatment has no spillover effects on units outside the treated group (Columbia University, 2023). Additionally, as the data source used for the empirical regression is provided by the U.S. Bureau of Transport Statistics (BTS) as a quarterly panel dataset a regression with fixed effects based on time and airport-pair groups is included (Vermeersch, 2007). The introduction to the dataset and data source used in the empirical research is provided in the next subsection 3.2, followed by subsection 3.2.1 which briefly explains the construction of the final dataset, and lastly subsection 3.3 will focus on the structure of the regression used based on the DID approach and will include the composition of the time periods and groups used, as well as the examination of the main assumptions underlying the regression methodology.

3.2 Data

The data used in this study for the years of interest is derived from the Office of Airline Information of the U.S. Bureau of Transport Statistics which is part of the U.S. Department of Transportation (DOT). The data source is the DOT Origin and Destination Survey (DB1B) database, which is derived from a 10 percent random sample of airline ticket data for all U.S. domestic flights in each quarter for each given year since 1993 of reporting carriers. The DB1B dataset provides information on origin and destination airports, marketing and operating carriers for each route, quarter of travel, airfare, and number of passengers associated with each airfare. The dataset consists of three separate databases divided into Coupon, Market and Ticket databases.

The Coupon database contains information about each leg of a ticket, including origin and destination airports, airlines, coupons per ticket, number of passengers, and distance flown. The Market database focuses on market-level characteristics such as origin and destination airports, market fare, miles flown, and carrier change indicators. The Ticket database provides basic information about individual tickets, including itinerary details, fares, number of passengers, and miles flown.

3.2.1 Construction of the final dataset, descriptive and summary statistics

To use the DB1B dataset from the BTS Transtats database, consisting of three different databases (Coupon, Market, Ticket), it is necessary to merge and collapse the different data sources. This subsection gives a short insight about the procedure of constructing the final dataset. The first step regards the merge of the three different databases into one. Observations containing three or more *coupons*[5], a distance value of zero, or two or more *marketcoupons* were eliminated. The datasets were then merged based on a created id variable, resulting in a final merged dataset that contained all relevant information. To ensure the quality of the data, the merged dataset underwent cleaning and filtering procedures. Observations where the carrier did not match the operating carrier, observations where there was no online availability, or where the fare was classified as a bulk fare were excluded. In addition, observations with a dollar credit of zero were removed. Further adjustments were made to the *itinfare* variable halving the value for round trips. In addition, observations with *itinfare* values less than 10 were eliminated. To account for potential outliers, the 99th percentile of the *itinfare* variable was calculated and observations exceeding the 99th percentile were then excluded from the dataset. As a final step, a unique identifier route carrier id was generated for each observation based on the combination of origin and destination airport and

[5] Coupon refers to a flight segment within an itinerary, which can consist of one or more coupons representing a single flight segment between to airports (Airlab, 2019)

carrier to ensure the uniqueness of observations across the data source. In a second step, the merged dataset was subjected to a collapsing procedure aimed at aggregating observations based on a unique identifier route carrier id and the period specified by the variables indicating the year and quarter. Purpose of this step was to summarize and consolidate the data. Collapsing the dataset resulted in a new dataset with 133,022 quarterly airport-pair carrier airfare observations for the years between 2016 to 2019. Table 3 provides descriptive statistics of the most relevant variables in the final merged dataset and table 4 illustrates the summary Statistics for most relevant variables.

Table 3: Descriptive Statistics for most relevant variables in the final merged dataset

Variable Name	Variable Label
year	Year of observation
quarter	Quarter of observation
apc_id	Route Carrier ID Numeric
origin	IATA Airport Code for Origin
dest	IATA Airport Code for Destination
opcarrier	Operating Carrier IATA Airline Deisgnator
apcarrier_id	Route Carrier ID
originairportid	Identification number by US DOT for Airport
origincitymarketid	Identification number by US DOT for city market
destairportid	Identification number by US DOT for Airport
destcitymarketid	Identification number by US DOT for city market
itinfare	Average Itinerary Fare per Person
passengers	Number of passenger (10% random sample)
airline	Name of the operating carrier
US_Carrier_Category	Airline Category of carrier (LCC, NLC, ULCC, etc.)

Table 4: Summary Statistics for most relevant variables in the final merged dataset

Variable	Mean	SD	Min	Max
year	2017.52	1.11	2016	2019
quarter	2.52	1.11	1	4
itinfare	226.38	117.73	11	3200
passengers	582.52	917.01	1	12352

Total number of observations=133,022.

The variable considered most relevant in the empirical analysis is *itinfare*, which serves as the dependent variable and represents the average airfare per person for a given itinerary, which includes the trip from origin to destination airport. For the empirical research the natural logarithm of *itinfare* will be used. By taking the natural logarithm of the variable the risk of skewness can be addressed by mitigating it as shown in Appendix A6. In addition, by using the natural logarithm of a variable, it enables to interpret the coefficients in the regression tables as percentage changes (West, 2022). Table 4 shows that the average airfare across all observations in the dataset is $226.38, with the highest recorded airfare being $3200. Appendix A7 in addition shows how this information is structured in the dataset. For instance, it presents the observation for the American Airlines route between New York John F. Kennedy International (JFK) and Orlando International (MCO), by showing the average airfare for the first quarter of 2016 and shows that the average airfare was $233.56. Appendix A7 also includes the variables *year* and *quarter*, indicating the period of observation, the airport of origin and destination, identified by the respective IATA airport code, such as JFK for John F. Kenney International Airport in New York or MCO for Orlando International, and the variable *opcarrier*, defining the operating carrier of each observation by the respective IATA airline designator code, such as AA for American Airlines or UA for United Airlines. Additionally, the dataset includes several identification numbers by the U.S. Department of Transport to classify the respective regions and airports. The variable *passengers* defines the number of passengers on a given route. However, it's important to note that the DB1B dataset used is a 10% random sample of ticket data. From Table 4, one can derive that the average number of passengers across all observations is 582.52. It is worth noting that there is at least one observation in the dataset with a count of 1 passenger, indicating a minimum value. On the other hand, the dataset also contains a record with the highest recorded number of passengers for a respective quarter and a respective route, which is 12,352. In addition, several variables were created based on the data provided by the database, the first being the route carrier id variable as previously discussed, as well as a categorical variable indicating the respective airlines operating in the U.S.

domestic market and a second categorical variable indicating the business model category of the respective airline in the dataset, indicating whether the route is operated by an NLC, an LCC, or another category. Appendix A3 presents an overview of the distribution of observations by carrier, highlighting that most observations are associated with the LCC Southwest Airlines, followed by the legacy carriers American Airlines and Delta Air Lines. On the other hand, regional carriers such as Horizon Air, Island Air, Republic Airline, and SkyWest Airlines contribute the smallest percentage of observations. These regional carriers typically operate in partnership with NLCs, offering feeder flights under the NLC brand (SkyWest Airlines, 2022). Appendix A8 shows the distribution of carrier categories by business model in the dataset. Most carriers in the dataset are defined as LCCs, followed by NLCs and ULCCS. A detailed overview about how each category and each U.S. domestic carrier were assigned to in the dataset is provided in Appendix A2. After having introduced and described the most relevant variables included in the final dataset constructed through merging and collapsing the next subsection presents the regression structure used in this study. The arrangements of time periods and the classification of treatment and control groups will be introduced. In addition, an evaluation of the critical assumptions underlying the regression methodology for unbiased results will be conducted.

3.3 Empirical Regression

This study employs the DID estimation technique commonly used in prior literature when studying airline mergers and its impact on average airfares between the pre- and post-merger periods on the routes where the merger took place and the unaffected routes. DID allows to isolate the causal effect of the merger while controlling for unrelated factors and relying on two critical assumptions, the Parallel Trend Assumption, and the SUTVA Assumption, to obtain unbiased results. As a DID estimation technique is used, it is necessary to define a treated group, a control group, and a pre- and post-treatment period. In the context of this study about the competitive effects of a merger, the treated group refers to those routes that are directly affected by the merger between the LCC and the NLC and are thus expected to have significant competitive effects due to a change in market concertation between the operating carriers. The set of routes considered for the treated group consists, on the one hand of overlapping routes (routes on which both carriers competed before the merger) and, on the other hand, of non-overlapping routes (routes on which one carrier operated without the presence of the other merging carrier). On both type of routes, a risk of a potential increase in market share that could have an impact on airfares is present. Unaffected routes, which are routes operated by all other U.S. carriers other than the merging carriers, serve as a control group for the regressions testing Hypothesis 1 and 2.

When examining the pre- and post-merger periods, it is important to consider the integration process of the merging carriers. The merger transaction was announced on April 4, 2016, closed in January 2017, and resulted in an approved single operating certificate and brand for the merged entity in early 2018. Hence, for the analysis of Hypothesis 1, the pre-merger period covers Q1 2016 to Q4 2017 and the post-merger period covers Q1 2018 to Q4 2019. The decision to use two years for both the pre-merger and post-merger periods is consistent with previous research, such as the study by Carlton et al. (2017). For Hypothesis 2, which examines whether airfares increased only in the short term or also in the long term after the merger, the pre-merger period remains unchanged from Hypothesis 1. However, the post-merger period is split into post-merger period 1 from Q1 2018 to Q3 2018 and post-merger period 2 from Q4 2018 to Q4 2019.

3.3.1 Model specification

The following empirical analysis based on the defined pre- and post-treatment periods, treatment and control groups examines several regression stages based on the general difference-in-differences formula shown in Equation 1 and constructed with regards to the empirical analysis of this paper in the form as shown in Equation 2.

Equation 1:

$$Y_{it} = ß_0 + ß_1 * D_i + ß_2 * T_{i,t} + \delta * D_i * T_{i,t}$$

Equation 2:

$$Y_{it} = ß_0 + ß_1 TreatedRoutes_i + ß_2 TreatedPeriod_t + ß_3\ MergerEffect_i Post_t + ß_4\ AS\_VX\_Effect_i Post_t + \gamma_i + \varepsilon_{i,t}$$

In the model defined as Equation 2 one observation consists of a flight itinerary *i* operated by a defined carrier in a particular quarter and year *t*. The main independent variable of interest is the interaction term which is represented by $MergerEffect_iPost_t$ which as defined by Carlton et al. (2017) due to the dependent variable in logarithmic form indicates the percentage change in average airfares on affected routes between the pre-merger and post-merger period relative to the change in average airfares on control routes (Carlton et al., 2017). This variable takes a value of 1 if the route is affected by the merger and in the post-merger period, and zero otherwise and is constructed as an interaction term between two dummy variables, $TreatedRoutes_i$ and $TreatedPeriod_t$. $TreatedRoutes_i$ indicates the two groups represented by the treatment status, where 0 indicates routes who are not affected by the merger (control group) and 1 indicates routes who are affected by the merger, (treatment group). $TreatedPeriod_t$ indicates the two time periods, which are t = 0 and t = 1, 0 indicating the period before the merger and 1 indicating the period after the merger. As assessed in subsection 3.3, the variable $TreatedRoutes_i$ is defined first by all overlapping routes, routes on which both merging carriers competed prior to the merger, and second by all non-overlapping routes, all routes where one merging carrier operated prior to the merger without the other merging carrier being present. As an extension the non-overlapping routes are further subdivided into only those routes where Alaska operated prior to the merger without Virgin present and vice versa. The dependent variable Y_{it} is described by the natural logarithm of the average airfare per person on a given flight itinerary in a particular quarter and year operated by the respective carrier. Furthermore, Equation 2 includes an interaction term between a dummy indicating the presence of the merging carriers and the variable treated period, defined as *AS_VX_Effect_Post*, capturing the effect of the presence of the merged entity in the post-merger period, and industry fixed effects that are introduced at different stages, identified as γ_i, controlling for different carriers present in the dataset and business model categories of the carriers in the U.S. allowing to control for factors that could affect the airfare as a dependent variable but remain constant over time, thus allowing to account for unobserved factors that are specific to each unit when estimating causal effects from panel datasets (Imai & Kim, 2019).

3.3.2 Evaluation of DID estimation assumptions

Before proceeding with the empirical analysis and estimation results, it is important to first assess whether the Parallel Trend Assumption, the most critical assumption which implies the internal validity of DID models, and the SUTVA assumption, that implies that the composition of the groups remains constant, hold on the basis of the treatment and control groups defined, as the fulfillment of both assumptions is necessary for an unbiased DID estimation technique. This evaluation will determine the validity of the selection of the treatment and control groups for further analysis. The analysis first assesses the fulfilment of both assumptions for the overlapping routes shown in figure 1, and then additionally assesses the fulfilment of the assumptions for the non-overlapping routes in figure 2.

Figure 1: Average airfare for treatment and control group for overlapping routes

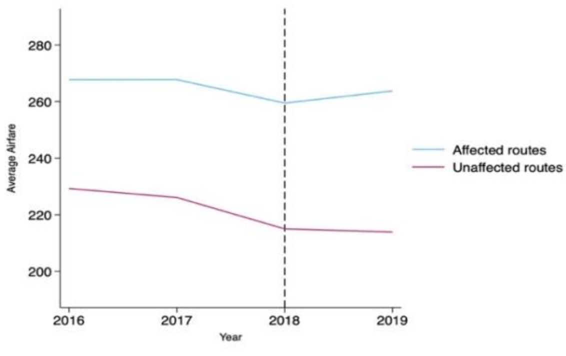
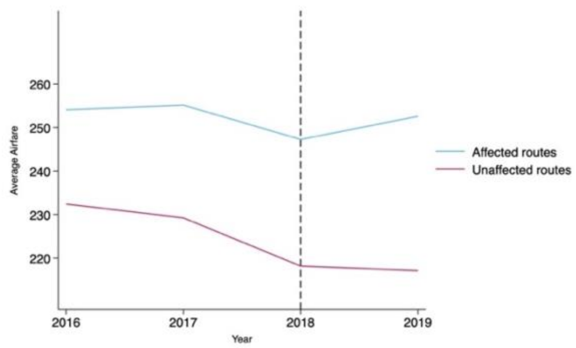


Figure 1 shows the average airfare for both constructed groups over time between 2016 and 2019. The blue line indicates the average airfare on the from the merger affected overlapping routes, while the red line indicates the average airfare on the selected control routes, which are the routes unaffected by the merger. The vertical line indicates the time of the merger considered as the treatment, which is in the beginning of 2018. The following observations can be made about the graph showing the two groups. First, the merger-affected routes have a higher average fare than the control routes. It is reasonable to expect that the presence of LCCs and ULCCs, which together make up 63.23% of the final sample according to Appendix A6, has a significant impact on the average airfare of the control group. This is further strengthened by the fact that ULCCs mainly operate at smaller secondary airports not served by both merging parties, and thus as the routes are not part of the treated airport pairs most of the ULCC route observations are part of the control group. This is evidenced by the fact that the control group has a lower average airfare than the treatment group. Indeed, as can be seen in Appendix A4, the average airfare for the control group is $220.93 and the average airfare for the treatment group is $264.68. Second, visual inspection of both graphs indicates that the Parallel Trend Assumption for the overlapping routes holds, as no major differences in the pre-treatment trend can be observed, suggesting that any differences in the post-treatment outcomes between the treated and control groups are due to the treatment itself. A closer look at Figure 1 reveals that the trends of the two lines start to diverge significantly after the actual treatment, namely the approval by the U.S. Department of Justice and the issuance of a single operating certificate and the start of operating under a single brand at the beginning of 2018, indicating that the treatment has an impact on the average airfare of the treated routes selected for the empirical analysis. The blue line, which shows the trend of the treatment group, is increasing and the red line, which shows the trend of the control group, is slightly decreasing. Regarding the SUTVA assumption, which states that in a repeated cross-sectional design, both the treated and control groups maintain consistent composition and that the treatment does not affect units outside the treated group, it is assumed that this assumption holds, since the treated routes remain constant over the period of analysis. In addition, the control group remains unchanged throughout the analysis period, and meeting the Parallel Trend Assumption, where the treated and control groups have similar pre-treatment trends, increases the likelihood of meeting the SUTVA assumption. Since, both, the Parallel Trend Assumption and the SUTVA assumption are satisfied based on both defined groups for a DID estimation, unbiased estimators and hence unbiased results can be assumed as the control group can be taken as a valid counterfactual for the trend of the treatment group, leading to the empirical regression and the evaluation of the provided estimation results in Section 4.

Figure 2: Average airfare for treatment and control group for non-overlapping routes



Regarding the evaluation of the necessary assumptions regarding a DID regression for the non-overlapping routes, again, the following observations can be made about the graph showing the two groups, with the blue line representing the treated group and the red line representing the control group. The first is that the treated routes account for a higher average airfare than the control routes. The average airfare as one can derive from Appendix A5 for the control group is $224.11 and the average airfare for the treated group is $252.26. Second, visual inspection of the plots indicates that the Parallel Trend Assumption holds, as no major differences in the pre-treatment trend can be observed, suggesting that any differences in post-treatment outcomes between the treated and control groups are due to the treatment itself. Again, a closer look at figure 2 shows that the trends of the two lines begin to diverge after the actual treatment. The SUTVA assumption can be considered satisfied since the treated routes remain constant over the period of analysis. In addition, the control group remains unchanged throughout the analysis period. Since Parallel Trend and the SUTVA assumptions are satisfied based on the defined groups, unbiased estimators can be assumed as the control group can be taken as a valid counterfactual for the trend of the treatment group, leading to the empirical regression and the evaluation of its results, which is carried out in Section 4. In addition, to examine potential multicollinearity problems in the empirical analysis, correlation matrices for overlapping and non-overlapping routes for both Hypotheses are included in appendix A9 to A12, providing information on the relationship between variables in each regression.

4. Estimation results

Since the dependent variable is expressed in natural logarithmic form to reduce the risk of skewness, as discussed in subsection 3.2.1, the coefficient cannot be interpreted directly. Instead, the formula in Equation 3 must be used when determining the percentage effect on the outcome variable. This applies to the evaluation of both Hypotheses 1 and 2.

Equation 3:

$$\left[\left(e^{Coefficient}\right) - 1\right] * 100$$

By applying the exponential function to the coefficients in the regression model, we can derive the multiplicative factor associated with a one-unit increase in each independent variable. This approach allows to interpret the coefficients in terms of approximate percentage changes in the dependent variable. In the context of the average airfare, the results indicate the extent to which the airfare is expected to increase as a percentage for each one-unit increase in the relevant independent variable.

4.1 Regression - First Hypothesis

The empirical analysis of the first Hypothesis, which evaluates whether the merger between an NLC and an LCC leads to a decrease or increase in airfares on the routes where the merger took place and if the decrease or increase is mainly driven by the merged carrier, consists of different regression stages based on different types of routes – overlapping and non-overlapping routes. As an extension, to determine whether there have been differences between the routes operated by one of the merging carriers without the other being present on the route, the non-overlapping routes will be further subdivided in *AS Non-Overlap*, routes operated only by Alaska prior to the merger without Virgin present, and *VX Non-Overlap*, routes operated only by Virgin prior to the merger without Alaska present. These stages will provide the structure for the following subsection, which presents the empirical results for Hypothesis 1.

The results will start with the initial model, including only the dependent variable, the constant and the dummy variables created for the DID estimation, indicating the two groups and the pre- and post-treatment periods, in addition to the interaction between the two dummy variables. Additional control variables controlling for industry fixed effects and an interaction term between a dummy indicating the presence of the merged carrier on the respective route and the treated period are included over the next stages, leading to an increase in variables until reaching the final baseline regression including all the necessary variables and defined as regression 5 in table 5 and as regression 3 in table 6. The extension regarding the differences within the non-overlapping routes will be provided in table 6 as regression 4 and 5. All stages are evaluated and interpreted separately, starting with the overlapping routes, and followed by the non-overlapping routes. Table 5 shows the most relevant regression results regarding Hypothesis 1 for the overlapping routes. A more detailed overview for all regression stages and its results is provided in Appendix A13. The regression estimates of the different estimated models are shown in columns 1 to 5, with the estimated coefficients for the main variables, the standard errors in brackets, the significance level indicated by asterisks and the corresponding R-squared value. The same applies to table 6 reporting the results of the regression with regards to Hypothesis 1 for the non-overlapping routes. Again, a more detailed overview for all regression stages and its results is provided in Appendix A14 and regarding the extension in A15.

In evaluating and interpreting the estimation results, a major focus should be placed on the DID interaction term variable *MergerEffect_Post* as used by and Le (2016) or Carlton et al. (2017). This term indicates the combined effect of being in the set of routes considered as the treated ones and in the post-merger period and is therefore relevant in assessing whether the merger between the NLC and the LCC leads to an increase or decrease in airfares on the routes affected by the merger. However, this variable suggests the effect for all present carriers on the affected routes and thus is not providing the answer to the question if the effect on the airfare is mainly driven by the merging carriers. Hence, in regression 5 of table 5 and in regression 3 of table 6, a major focus should be placed on the interaction term introduced in subsection 3.3.1 *AS_VX_Effect_Post* capturing the effect on airfares by the merged carrier on the routes affected by the merger in the post-merger period. To interpret the effect caused by the merged entity and regarding the question if the merged entity is the main driver of the changes in airfares, the sum between the variable *MergerEffect_Post* and *AS_VX_Effect_Post* must be calculated, and a joint f-test must be conducted to confirm the validity of the results. The same applies to the extension regarding the differences within the non-overlapping routes by defining two different set of treated routes, routes operated by Alaska prior to the merger without Virgin being present, and routes operated by Virgin prior to the merger without Alaska being present, provided in regression 4 and 5 of table 6. Here again the sum between *MergerEffect_Post* and *AS_VX_Effect_Post* must be calculated, and a joint f-test must be conducted to confirm the validity of the results.

Table 5: Regression Results overlapping routes for the main variables of interest – H1

Variable	(1)	(2)	(3)	(4)	(5)
Treated_Routes	0.194***	0.039***	0.039***	0.039***	0.042***
	(0.006)	(0.004)	(0.004)	(0.004)	(0.005)
MergerEffect_Post	0.063***	0.018***	0.018***	0.018***	0.011
	(0.009)	(0.006)	(0.006)	(0.006)	(0.007)
AS_VX_Effect_Post	-	-	-	-	0.021*
					(0.011)
U.S. Airlines Fixed Effects	No	Yes	Yes	Yes	Yes
Airline Category Fixed Effects	No	No	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	No	No	No	Yes	Yes
Constant	5.258***	5.468***	5.334***	5.468***	5.457***
	(0.002)	(0.006)	(0.004)	(0.006)	(0.008)
R-squared					
Within:	*0.019*	*0.047*	*0.618*	*0.618*	*0.618*
Between:	*0.522*	*0.400*	*0.891*	*0.891*	*0.891*
Overall:	*0.018*	*0.045*	*0.619*	*0.619*	*0.619*
Number of observations	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*

Note: Standard errors can be found in parentheses.
*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Looking at table 5, the implications of the coefficients are clear. The merger between the NLC and the LCC can be associated on average with an increase in airfares on the merger affected overlapping routes relative to the non-affected routes, from Q1 2018 onwards, as evidenced by the *MergerEffect_Post* coefficient, which has a positive and significant sign in regressions 1 to 4 presented.

Again, when looking at table 6 below, the implications of the coefficients are clear. On average, the merger can be associated with an increase in airfares on affected non-overlapping routes relative to unaffected routes. This is evidenced by the *MergerEffect_Post* coefficient, as used by and Le (2016) or Carlton et al. (2017), which has a positive and significant sign in regression 1 and 2. On average, the results indicate an increase in the average airfare on the routes where the merger took place, suggesting that the merger could have led to increased market power for the merged entity, with implications for consumer prices and welfare losses.

Table 6: Regression results non-overlapping routes for the main variables of interest – H1

	Non-Overlapping routes			AS Non-Overlap	VX Non-Overlap
Variable	(1)	(2)	(3)	(4)	(5)
Treated_Routes	0.147***	-0.014***	-0.009	-0.179***	-0.242***
	(0.008)	(0.005)	(0.006)	(0.022)	(0.048)
MergerEffect_Post	0.063***	0.019***	0.010	0.019	-0.014
	(0.011)	(0.007)	(0.008)	(0.032)	(0.071)
AS_VX_Effect_Post	-	-	0.023**	0.031***	0.031***
			(0.011)	(0.009)	(0.009)
U.S. Airlines Fixed Effects	No	Yes	Yes	Yes	Yes
Airline Category Fixed Effects	No	Yes	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	No	Yes	Yes	Yes	Yes
Constant	5.257***	5.520***	5.507***	5.500***	5.500***
	(0.002)	(0.006)	(0.009)	(0.007)	(0.007)
R-squared					
Within:	*0.008*	*0.617*	*0.617*	*0.618*	*0.617*
Between:	*0.584*	*0.892*	*0.892*	*0.892*	*0.892*
Overall:	*0.008*	*0.619*	*0.619*	*0.619*	*0.619*
Number of observations	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*

Note: Standard errors can be found in parentheses.
*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Starting with the evaluation of the results obtained for the overlapping and non-overlapping routes, the first regression in table 5 and 6 which includes only the dependent variable, the constant and the variables created for the DID estimation, suggests an increase in airfares in the post-merger period. Overlapping routes are associated with a 6.5% at the 1% significant level increase in airfares on the affected routes relative to those unaffected in the post-merger period, ceteris paribus, indicating that the elimination of a direct competitor on the route increases the airfare. Non-overlapping routes, are surprisingly also associated with a 6.5% at the 1% significant level increase in airfares on the by the merger affected routes compared to the unaffected ones in the post-merger period, keeping all other factors fixed. To strengthen these findings additional control variables are included until reaching the baseline regression defined as regression 4 in table 5 for the overlapping routes and as regression 2 in table 6 for the non-overlapping routes. As a first step a control variable

U.S. Airlines fixed effects is included, controlling for the 16 carriers operating in the U.S. domestic market between 2016 and 2019, which are listed in Appendix A3. This stage is followed by including the second control variable Airline Category fixed effects, controlling for different categories of airline business models present in the U.S. domestic market as shown in Appendix A8, and by interacting both control variables included for the fixed effects. A detailed overview of all regression stages with its results is provided in Appendix A13 and A14. When having included all the control variables the overlapping routes as indicated in table 5 regression 4 are associated with a 1.8% at the 1% significant increase in airfares on the routes affected by the merger relative to the unaffected routes in the time after the merger, ceteris paribus. Non-overlapping routes are associated as indicated in table 6 regression 2 with a 1.9% at the 1% significant increase in airfares on the affected routes relative to those unaffected in the post-merger period, keeping all other factors fixed. However, we still do not know whether this increase in airfares on the affected overlapping and non-overlapping routes is driven by all carriers present on those routes, or whether the increase is driven by the merged carrier. Furthermore, if the merged entity is the main driver of the airfare increases, it would be interesting to evaluate as the merging carriers operated different business models, if the increase in the airfare is stronger on the routes where only Virgin America or only Alaska Airlines were present before the merger without the other merging carrier present. Regarding the question if the merged carrier is the main driver of the increase in airfares the visual inspection of figures 1 and 2 in subsection 3.3.2 is suggesting that both merging carriers are mainly driving the increase in airfares, as the graphs of the affected and unaffected routes start to diverge from Q1 2018 onwards, the time of the issuance of a single operating certificate by the U.S. Department of Justice and the introduction of a single brand. To assess this empirically a new regression is carried out including a new variable defined as *AS_VX_Effect_Post* indicating the effect on airfares by both merging carriers in the post-merger period on the respective routes and will provide an answer to the question regarding the main driver of the effect. When looking to table 5 showing the estimation results for the overlapping routes, the fifth regression suggests that the increase in the average airfare on the affected routes is mainly driven by the merging carriers. This observation is relying on the finding that the DID interaction term *MergerEffect_Post* becomes insignificant at this stage and that the new included interaction term *AS_VX_Effect_Post* is significant at the 10% significance level and has a positive sign. Thus, on overlapping routes, the new merged entity by summarizing the coefficients of *MergerEffect_Post* and *AS_VX_Effect_Post* is associated with an increase in airfares of approximately 3.3% on the routes where the merger took place relative to the unaffected routes in the post-merger period, ceteris paribus. A conducted joint f-test for the two coefficients is confirming the validity of the results as the p-value is 0.001. The findings are also confirmed, when looking to table 6 which is showing the estimation results for the non-overlapping routes in the third regression. Again, this observation is relying on the finding that the DID interaction term *MergerEffect_Post* becomes insignificant at this stage and that the new included interaction term *AS_VX_Effect_Post* is significant at the 5% significance level and has a positive sign. Hence, on non-overlapping routes, the new merged carrier operating is associated with an increase in airfares of approximately 3.4% on the routes where the merger took place relative to the unaffected routes in the post-merger period, ceteris paribus. A conducted joint f-test is confirming the validity of the results as the p-value is 0.002. Regarding the extension about the differences within the non-overlapping routes the results in table 6 suggest that the increase in airfares in the post-merger period on the routes where the merger took place are mainly driven by routes where only Alaska Airlines was present with an airfare increase of 5.1% significant at the 1% level compared to a 1% significant airfare increase of 1.7% on routes where only Virgin was present before to the merger, relative to the routes where no merger took place, ceteris paribus. The validity of the results is again confirmed by a joint f-test with a p-value of 0.003 for both regressions 4 and 5 in table 6. The results indicate an increase in average airfares on both overlapping and non-overlapping routes where the merger took place. In addition, the results suggest that the increase in average airfares is mainly driven by the merged carrier and, surprisingly, this increase is stronger on the routes where Alaska Airlines, the Network Legacy

Carrier, operated prior to the merger, without the other merging carrier being present on the respective route. Hence, based on the results obtained, Hypothesis 1 can be confirmed as an increase in airfares mainly driven by the merged carrier, on the merger affected routes relative to those unaffected is found.

4.2 Regression - Second Hypothesis

Based on the findings regarding the first Hypothesis suggesting anticompetitive effects on the affected routes caused by the merged entity, it is relevant to assess whether the found effect is a short- or long-term airfare increase. To evaluate this question, a second empirical analysis is conducted, consisting of different regression stages based on overlapping and non-overlapping routes. Again as an extension, the non-overlapping routes will be again subdivided to determine whether there have been differences between the routes operated by one of the merging carriers without the other being present on the route. These stages again provide the structure for the following subsection, which presents the empirical results for Hypothesis 2. The results will start with the initial model, including only the dependent variable, the constant and the dummy variables created for the DID estimation, indicating the two groups and the pre- and the two post-treatment periods, as the post-merger period is split into post-merger period 1 from Q1 2018 to Q3 2018 and post-merger period 2 from Q4 2018 to Q4 2019, in addition to the interaction between the two dummy variables. Again, additional control variables controlling for industry fixed effects and two interaction terms between a dummy indicating the presence of the merged carrier on the respective route and the two treated periods are included at each stage, leading to an increase in variables until the final baseline regression defined as regression 2 in table 7 for the overlapping and non-overlapping routes is reached. A more detailed overview of the results for all regression stages regarding overlapping and the non-overlapping routes can be found in Appendix A16 to A18.

Table 7: Regression results for the main variable of interest – H2

	Overlap		Non-Overlap		AS Non-Overlap	VX Non-Overlap
Variable	(1)	(2)	(1)	(2)	(3)	(4)
Treated_Routes	0.194***	0.042***	0.147***	-0.008	-0.179***	-0.242***
	(0.006)	(0.005)	(0.008)	(0.006)	(0.022)	(0.048)
MergerEffect_Post_Period1	0.005***	0.009	0.040***	0.012	0.015	-0.022
	(0.012)	(0.009)	(0.015)	(0.011)	(0.043)	(0.097)
MergerEffect_Post_Period2	0.074***	0.012	0.077***	0.008	0.021	-0.009
	(0.010)	(0.008)	(0.012)	(0.009)	(0.037)	(0.081)
AS_VX_Effect_Post_Period1	-	0.001	-	0.000	0.009	0.009
		(0.015)		(0.014)	(0.012)	(0.012)
AS_VX_Effect_Post_Period2	-	0.035***	-	0.039***	0.046***	0.046***
		(0.013)		(0.013)	(0.011)	(0.011)
U.S. Airlines Fixed Effects	No	Yes	No	Yes	Yes	Yes
Airline Category Fixed Effects	No	Yes	No	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	No	Yes	No	Yes	Yes	Yes
Constant	5.258***	5.456***	5.271***	5.510***	5.499***	5.500***
	(0.002)	(0.008)	(0.002)	(0.008)	(0.007)	(0.007)
R-squared						
Within:	*0.019*	*0.618*	*0.008*	*0.617*	*0.618*	*0.617*
Between:	*0.537*	*0.893*	*0.565*	*0.893*	*0.893*	*0.893*
Overall:	*0.018*	*0.620*	*0.008*	*0.619*	*0.619*	*0.619*
Number of observations	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*

Note: Standard errors can be found in parentheses.
*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

When evaluating and interpreting the estimation results with respect to the question of whether the increase in airfares is a short-term or whether this increase is present in the long-term, a major focus should again be placed on the DID interaction term variable. Hence first on the variable *MergerEffect_Post_Period1*, indicating the combined effect of being in the set of routes considered as treated and in the first post-merger period from Q1 2018 to Q3 2018 and second on the DID interaction term variable *MergerEffect_Post_Period2*, indicating the combined effect of being in the set of affected routes and in the second post-merger period from Q2 2018 to Q4 2019. As these variables suggest the effect for all present airlines on the affected routes in the respective period and hence are not providing the information if the effect on the airfare is mainly driven by the merging carriers in, in regression 2 of table 7 a major focus should be placed on the variables *AS_VX_Effect_Post_Period1* and *AS_VX_Effect_Post_Period2*, indicating an the effect of both merging carriers in the post-merger period on the average airfare.

Regression 1 in table 7 including only the dependent variable, the constant and the variables created for the DID estimation suggests anticompetitive effects and provides the information that the airfare has a stronger increase from Q4 2018 onwards. Overlapping routes in the first post-merger period are associated with a 0.5% at the 1% significant level increase in airfares on the affected routes relative to those unaffected, ceteris paribus. In the second post-merger period overlapping routes are associated with a 7.7% at 1% significant level increase in airfares on the routes affected relative to those unaffected, keeping all other factors fixed. The same observation applies to non-overlapping routes where the results suggest in the first post-merger period an increase by 4.1%, significant at the 1% level, and in the second post-merger period an increase by 8%, significant at the 1% level, for the affected routes relative to those unaffected, ceteris paribus. The findings that the second post-merger period is the main driver of the airfare increases are strengthened when including U.S. airlines fixed effects, Airline Category fixed effects, and by interacting the two control variables included for the fixed effects as shown in Appendix A15 and A16. When observing regression 2 in table 7 for evaluating whether the found anticompetitive effect present from Q1 2018 onwards, which is stronger in the second post-merger period, on affected overlapping and non-overlapping routes is driven by all present carriers on the respective routes or by the merged carrier, one gets the following observations. The airfare increase on overlapping routes is mainly driven by the merged carrier. This observation is relying on the finding that the DID interaction term *MergerEffect_Post* for both periods get an insignificant result and that the included interaction term *AS_VX_Effect_Post_Period2* is significant at the 1% significance level and has a positive sign. Thus, on overlapping routes, the new merged carrier is associated with an increase in airfares of approximately 4.8% on the routes where the merger took place relative to the unaffected routes in the second post-merger period, ceteris paribus. The validity of the results regarding the second post-merger period for the overlapping routes is confirmed by a joint f-test with a p-value of 0.000 for regressions 2.

The airfare increase on non-overlapping routes is also mainly driven by the merged carrier. This observation is again relying on the finding that the DID interaction term *MergerEffect_Post* for both periods become insignificant and that the included interaction term *AS_VX_Effect_Post_Period2* is significant at the 1% significance level and the merged entity is associated with an increase in airfares of approximately 4.8% on the routes where the merger took place relative to the unaffected routes in the second post-merger period, ceteris paribus. The validity of the results regarding the second post-merger period for the overlapping routes is confirmed by a joint f-test with a p-value of 0.000 for regressions 2.

The findings additionally confirm that the main driver for the increase in airfare is the second post-merger period due to the insignificance of the variable *AS_VX_Effect_Post_Period1*. This result is confirmed for both type of routes, overlapping and non-overlapping, as a joint f-test regarding the first post-merger period is conducted providing a p-value of 0.474 for overlapping and 0.443 for non-overlapping routes confirming the insignificance and thus the validity of the results. When taking a look to the extension in regression 3 and 4 of table 7 the results suggest that the increase in airfares, as already assessed in H1, is again stronger on the routes where Alaska Airlines was operating prior to the merger without the other merging carrier present. Routes where only Alaska was present are associated in the second post-merger period with an increase of 6.9%, significant at the 1% level, compared to a 1% significant airfare increase of 3.8% on routes where only Virgin was present before to the merger, on routes where the merger took place relative to the routes where no merger took place, ceteris paribus. The significance and thus the validity of the results is confirmed by a joint f-test with a p-value of 0.000 for both regressions 3 and 4 in table 7. Also regarding the extension the empirical findings confirm again that the main driver for the increase in the airfare is the second post-merger period due to the insignificance of the variable *AS_VX_Effect_Post_Period1*. This result is further confirmed for both type of routes, as a joint f-test regarding the first post-merger period is conducted obtaining a p-value of 0.722 for *AS Non-Overlap* routes and of 0.443 for *VX Non-Overlap* routes confirming the insignificance and thus the validity of the results regarding the first post-merger period.

All the results obtained in table 7 confirm the finding of airfare increases on the affected overlapping and non-overlapping routes compared to the set of routes where no merger has taken place. This is also in line with the findings regarding Hypothesis 1. Additionally, the findings suggest that this effect is not short-lasting but further increases in the long term. Furthermore, the increase in airfares after taking place of the merger on the affected routes is mainly driven by the merged entity confirming the findings regarding Hypothesis 1 and surprisingly this long-lasting increase in airfares is again stronger on the routes where Alaska Airlines was operating before the merger without the second merging carrier operating on the respective route. Hence the results do not confirm the second Hypothesis that a merger between an NLC and an LCC leads to an increase in airfares only in the short-run, and not in the long-run on routes where the merger took place relative to the unaffected routes in the post-merger period.

4.3 Robustness Check

The estimation results evaluated above suggest that a merger between an NLC and an LCC leads to an increase in average airfares for the set or routes where the merger took place. Furthermore, the results suggest that this assessed anticompetitive effect is mainly driven by the new merged carrier and not by all carriers operating on the affected routes, and that the increase in airfares is associated with a longer period and is therefore not a short-term effect. Additionally, the findings suggest that the increase in airfares is stronger on the routes where Alaska Airlines, the

Network Legacy Carrier, was operating before the merger without the second merging carrier operating on the respective route.

As a first step to check the robustness of these findings, the data sample is adjusted by removing all airline categories that do not fit as potential competitors. Thus, all regional carriers and the carrier Hawaiian Airlines, which defines itself as a destination carrier, and therefore does not operate as a full NLC, nor as an LCC or ULCC, are dropped (Aviation Strategy Ltd., 2023). Additionally also the carrier Sun Country Airlines is removed from the data sample as the carrier, defined as an ULCC, relies on a hybrid business model focusing on scheduled passenger leisure flights and offering charter and cargo operations (CAPA - Centre for Aviation, 2022), (Sun Country Airlines, 2023). With regards to Hypothesis 1 the baseline regressions presented in table 5 and 6 in subsection 4.1 are run again with the smaller sample for the overlapping and the different non-overlapping routes. The results of the estimations are presented in Appendix A19. The results confirm the findings that the merger led to anticompetitive effects due to increase in airfares, as there are significant increases on both types of routes, as shown in regression 1. However, by evaluating whether the effect is mainly driven by the merged entity in regression 2 of Appendix A19, the findings suggesting that the increase is driven by the merged entity can only be confirmed for the set of non-overlapping routes, as for the overlapping routes positive but insignificant results are obtained. For the non-overlapping routes, positive and significant results are obtained. To evaluate the robustness of the results for Hypothesis 2, the baseline regressions from table 7 are run again and are presented in Appendix A20. The results obtained in Section 4.2 are confirmed suggesting that the anticompetitive effects of the merger on the affected overlapping and non-overlapping routes are not only short-lasting but further increase in the long term and that the anticompetitive effects on the affected two types of routes are driven by the merged entity. The findings regarding the extension suggesting that the increase in airfares is stronger on the routes where Alaska Airlines was operating before the merger without the second merging carrier can be confirmed regarding Hypothesis 1 and 2.

The same results found in Appendix A19 and A20 are confirmed in a second robustness check in which as in the study by Carlton et al. (2017), the time periods are changed, and the regressions are re-run. To test both Hypotheses, the pre-period is shortened by removing the first two quarters, Q1 and Q2 2016. An overview of the results is provided in Appendix A21 for Hypothesis 1 and in Appendix A22 for Hypothesis 2. With regards to Hypothesis 1, the results suggesting that the increase is driven by the merged entity operating under a single brand can again only be confirmed for the non-overlapping routes, as for the overlapping routes positive but insignificant results are provided. With regards to Hypothesis 2, the results are confirmed suggesting that the anticompetitive effects of the merger on the affected overlapping and non-overlapping routes are not only short-lasting but further increase in the long term and that the anticompetitive effects on the affected two types of routes are driven by the merged entity. The findings regarding the extension suggesting that the increase in airfares is stronger on the routes where Alaska Airlines was operating before the merger without the second merging carrier can be confirmed regarding Hypothesis 1 and 2.

As a third robustness check, based on the robustness checks performed by Carlton et al. (2017), the first year after the merger is excluded from the post-merger period, with the aim of allowing a longer period for the effects of the merger to take place (Carlton et al., 2017). Hence the year 2018 is removed from the sample. Based on the new and smaller sample the baseline regressions presented in tables 5 and 6 regarding Hypothesis 1 are run again for, overlapping and the different non-overlapping routes. The results of the estimations are presented in Appendix A23 and confirm the finding that the merger leads to a significant increase in airfares in the post-merger period, as there are significant increases on overlapping and non-overlapping routes, as shown in regression 1. The results also confirm that the effect is mainly driven by the merged entity on both type of routes as evaluated in regression 2. Regarding Hypothesis 2, as the year 2018 is excluded from the sample, new treated periods must be defined to evaluate if the airfare increase is only short-lasting or a long-term effect. Hence the post-merger period is split into post-merger period 1 including Q1 2019 and post-merger period 2 from Q2 2019 to Q4 2019. The results of the estimations are presented in Appendix A24 and confirm the finding that the anticompetitive effects of the merger on the affected overlapping and non-overlapping routes are not only short-lasting but increase in the long term and that the anticompetitive effects on the affected two types of routes are driven by the merged entity. The findings regarding the extension suggesting that the increase in airfares is stronger on the routes where Alaska Airlines was operating before the merger without the second merging carrier can be confirmed regarding Hypothesis 1 and 2.

The results of the set of alternative specifications based on revised data samples support the main findings derived from the main regression for the overlapping and the different non-overlapping routes, with regards to Hypothesis 1 and 2 and thus confirm the validity of the econometric model used already strengthened by the fulfillment of the Parallel Trend and by the SUTVA assumption for the main regression evaluated. Regarding Hypothesis 1 the findings from the main regression and the findings in the robustness checks strongly confirm the increase in average airfares mainly driven by the merged entity in the post-merger period for the non-overlapping routes. For the overlapping routes only one robustness check out of three confirms the finding of airfare increases by the merged entity. Regarding Hypothesis 2 the findings from both, the main regression and by the alternative specifications, suggest that the increases in airfares on the affected overlapping and non-overlapping routes are not only short-lasting but increase in the long term and that the anticompetitive effects on the affected two types of routes are driven by the merged entity. For both Hypotheses the findings that the increase in airfares after the merger are mainly driven by the routes where Alaska Airlines operated before the merger without the other merging carrier being present are also confirmed.

5. Discussion and Conclusion

5.1 Discussion

Since taking place of the U.S. Airline Deregulation Act of 1978 abolishing governmental regulation of the industry by the CAB, the airline industry has undergone significant and long-lasting changes. The act initiated free market mechanisms leading to a decrease in airfares and at the same time to a strong increase in number of flights and passengers (Bachwich & Wittman, 2016), (Barrows, 2018), (Goetz & Vowles, 2009). This trend has been further driven by the emergence of a new business model additionally to the classical NLCs as a new business model defined as Low-Cost Carrier was launched accounting for a global market share of 35% as of 2020. This demonstrates the important role that these carriers have in the industry giving major importance to competitive consequences of mergers including LCCs, such as the merger between an NLC and an LCC that took place in the United States in 2018 and was one of the first of its kind (Statista, 2022), (Budd & Ison, 2017), (Francis et al., 2006). Based on the available data source provided by the U.S. Bureau of Transport Statistic, the U.S. airline industry allows for an empirical ex-post analysis. Hence, the purpose of this study was to assess the competitive effects of a merger between an NLC and an LCC by assessing whether such a merger leads to increasing or decreasing airfares on the set of routes where te merger took place and, in the case of increasing airfares, whether this effect is short- or long-lasting. As an extension, the analysis also assesses the differences in effects on non-overlapping routes, routes operated only by Alaska prior to the merger without Virgin present, and routes operated only by Virgin prior to the merger without Alaska present.

After conducting a difference-in-differences regression the following results are obtained. Regarding Hypothesis 1, the empirical results, confirmed by several robustness checks, find strong evidence for anticompetitive effects by the merged entity in the post-merger period for the non-overlapping routes due to an increase in the average airfare. This finding is supported by previous literature, such as by Borenstein (1990), Kim and Singal (1993), and by Kwoka and Shumilkina (2010), who found evidence of an increase in the average airfare on routes where only one of the merging carriers operated prior to the merger (Borenstein, 1990), (Kim & Singal, 1993), (Kwoka & Shumilkina, 2010). Regarding the overlapping routes, the empirical results find the evidence of anticompetitive effects by the merged entity in the post-merger period as for the non-overlapping routes due to an increase in the average airfare. However, when conducting several robustness checks only one out of three checks can confirm this finding. Based on the findings for overlapping and non-overlapping routes it is interesting to note that the results for the non-overlapping routes suggest that the elimination of a potential competitor, since the second carrier of the merger was not active on the respective route prior to the merger, has a similar effect as the takeover of overlapping routes from a direct competitor. This finding is in line with the finding by Le (2016). Additionally, the findings suggest that the increase in airfares is stronger on the routes where Alaska Airlines was operating before the merger without the presence of the second merging carrier as the increase in average airfares is greater on the non-overlapping routes operated by Alaska than on the routes operated by Virgin prior to the merger. In this manner, Hypothesis 1 can be confirmed as the increase in airfares, mainly driven by the merged carrier, on the merger affected routes relative to those unaffected is mainly confirmed on all type of routes. The findings are also in line with the findings from previous literature which emphasized the anticompetitive effects being generated by mergers and indicate that the generated efficiency gains, are outweighed by the exercise of higher market power. This finding is also of interest since it suggests that the efficiencies of the LCC business model may be outweighed by the NLC cost structure. This observation is based on Kim & Singal's (1993) finding that an increase in airfares suggests that the market power effect dominates efficiency gains (Kim & Singal, 1993). Additionally, Carlton et al. (2017) suggests that efficiency gains such as network effects are more likely to occur when the merging carriers operate a H&S network which was not the case for the merging LCC carrier supporting the findings of the study (Carlton et al., 2017). Thus, based on the empirical findings, the merger is suggesting to having led to an increase in market concentration and, consequently, to the potential of exercising increased market power affecting the airfares. Regarding the extension finding that airfares increased more strongly on routes operated only by Alaska Airlines prior to the merger without Virgin being present on the respective routes, one reason could be that the routes taken over by Virgin America are highly competitive routes that do not allow for strong increases in airfares. Indeed, Appendix A1, which shows the route network of the two merging carriers, suggests that Virgin America operated mainly on West to East Coast routes such as the Los Angeles New York route, which are subject to highly competitive pressure from mainly all U.S. domestic carriers, unlike the routes operated only by Alaska Airlines in the Pacific Northwest or Alaska. This finding suggests that it is not only the business model of the merging carrier that is important when assessing the impact on airfares, but also the routes with their supply and demand characteristics on which the carrier operates, as this factor may predominate the cost structure of the different carriers based on their business model.

About Hypothesis 2, the empirical results and the alternative specifications conducted, suggest that the anticompetitive effects driven by the merged entity are not only short-lasting, as the increase in airfares on the overlapping and the non-overlapping routes, is present in the long-term. Hence the second Hypothesis deducted from previous studies such as by Hüschelrath and Müller (2015) stating that the increase in airfares due to the achievement of merger efficiencies in the long-run and the entry of competitors on the affected routes in the post-merger period is only short-lasting and not long-lasting, cannot be confirmed. However, this result for Hypothesis 2 has interesting implications. First it suggests that the increased market concentration of the merged entity increases the market power and thus allows the merged carrier to raise airfares. Second, since the effect of higher fares persists in the long run, greater emphasis needs to be given to the multimarket contacts that exist in the airline industry, as found by Evans and Kessides (1994). The results suggest that the presence of multimarket contact leads to higher airfares on routes served by airlines with extensive competitive contacts within the market (Evans & Kessides, 1994).

The findings of this study suggest that due to this steady competitive interaction between carriers, mutual forbearance can emerge, and that multimarket contact stabilizes oligopolistic coordination leading to a so called *"live-and-let-live policy"* in which the acting entities avoid price wars (Edwards, 1955). The aviation industry, which consists out of different markets, as every route is considered as an own market, offers the perfect landscape for multimarket contact, as a competitive conduct by one carrier on a respective route, could spill over to other routes affecting the competitive structure within the industry (Kim & Singal, 1993). By combining the findings of the empirical analysis of this study with the findings by Edwards (1955) and Evans and Kessides (1994) one can deduct the observation of a greater extent of multimarket contact since taking place of the merger. This may have increased the mutual forbearance as the merged entity is competing in the U.S. domestic market with the same competitors on more routes leading to higher incentives to collude, such as tacit collusion, and to avoid price wars.

As with most research, the empirical analysis in this study has a few limitations that must be considered. The first is related to the selected time periods and the duration of the time periods of the analysis. Based on the structure of the study by Carlton et. al (2017) and due to the big size of the different necessary datasets which have been merged into the final data sample used for the empirical analysis, the study covers only two years for the pre-merger and two years for the post-merger period. This study assesses the question if an increase or a decrease in the average airfare, hence pro- or anticompetitive effects, are present in the post-merger period on the routes where the merger has taken place and if this effect is long lasting. The results obtained from the regressions for the causal effect of the merger have been confirmed by several robustness checks. However, to validate and strengthen the findings of this study, future research should examine this effect on an extended pre- and post-merger period.

In addition, by using the DB1B database from the U.S. Bureau of Transport Statistics, it should be noted that the use of this database estimates the causal effect of the merger using data from the U.S. domestic market. As the airline industry is a global industry there may be a risk of different effects when applying these results to other markets, such as Europe or the Asia-Pacific (APAC) region. Hence, the results may not be fully applicable to other markets and may not strengthen the results for the industry on a global scale due to contextual differences, differences in industry dynamics and consumer behavior, market structure, market size, and different levels of competition between the US market and foreign markets. Despite the difficulties in finding databases similar to the DB1B with regard to other countries, future research should solve this problem by trying to analyze future mergers between NLCs and LCCs in other markets, such as in Europe or in the APAC region.

Furthermore, even by separating the routes in overlapping and in different non-overlapping routes there may be the risk that the average effect showing an increase in airfares, is not present on all the routes operated by the merged entity. For instance, there may be the finding that on the popular and competitive route a procompetitive effect is present on the route, however, this effect may be outweighed by an anticompetitive effect on the less popular route. Thus, future research should try to eliminate this possible bias that may occur by dividing for instance the routes into different levels of importance based on passenger numbers and economic indicators of the destination and origin cities. By analyzing each level independently, the results of this study could be further validated or even extended.

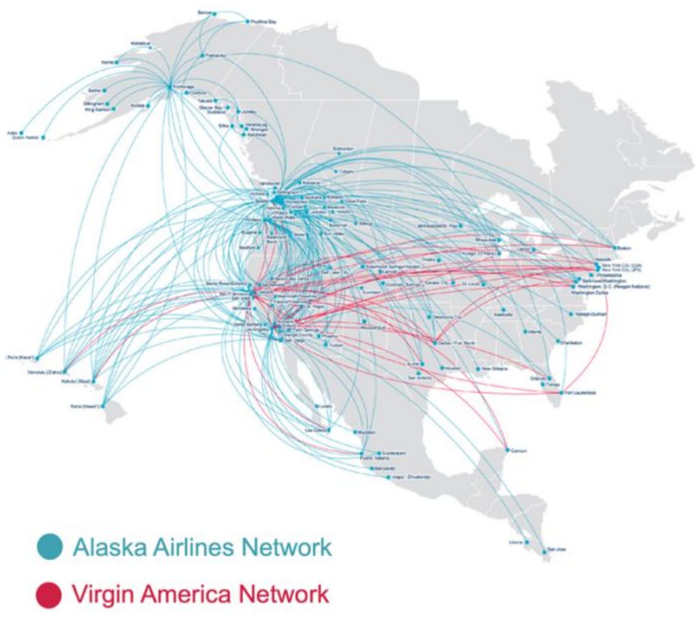
5.2 Conclusion

The aim of this study was to investigate if a merger between a Network Legacy Carrier and a Low-Cost Carrier has pro- or anticompetitive effects on consumer prices, represented by an increase or decrease in the average airfare, and how long these effects last. The merger between Alaska Airlines and Virgin America, both operating with a different business model, was one of the first of its kind and is of interest, as the number of LCCs continues to grow worldwide, which could potentially lead to further market consolidation through mergers between LCCs and NLCs in the future. In previous empirical literature, the effects of airline mergers on airfares have been widely discussed, analyzing mergers between NLCs, and the results mainly suggested anticompetitive effects. The estimation results of this study based on a DID estimation suggest regarding the research question that the merger between a Network Legacy Carrier and a Low-Cost Carrier resulted in an increase in the average airfare on the routes where the merger took place. Hence the findings are in line with previous studies. This increase in the average airfare is mainly driven by the merged entity suggesting that the increased market power by taking over routes from a competitor outweighs the potential efficiency gains associated with a merger. Interestingly, although one of the merging carriers operated an LCC business model focused on minimizing costs and maximizing efficiencies within the network, the results are consistent with previous studies that have assessed the impact of mergers between different NLCs. However, the findings of the study support those of Luo (2013), who found the evidence that changes in LCC competition had significant effects on airfares, while changes in NLC competition had only a small effect (Luo, 2013). Furthermore, the empirical results suggest surprisingly that this increase in the average airfare is associated with a longer period and is therefore not a short-term effect present on the routes affected by the merger. Also, in the long-term the increase is mainly driven by the merged carrier. As discussed above, one reason to confirm this finding could be the role of tacit collusion due to multimarket contacts within the U.S. domestic market, stabilizing the competitive landscape since active carriers prefer to avoid price wars, leading to an increase in airfares in the long run (Kim & Singal, 1993), (Edwards, 1955). In addition, the empirical analysis suggests that routes where the NLC Alaska Airlines operated without the other merging carrier present before the merger had a stronger increase in average airfares than on the routes where the LCC Virgin America operated before without Alaska Airlines being present suggesting that not only the business model operated by the respective carriers is of importance when assessing merger effects on airfares, but also the routes with its demand and supply characteristics where the carriers operate as this factor may predominate the cost structure by the different carriers based on their business model.

In conclusion, the empirical findings of this study indicate first that the different business models of the merging carriers do not significantly influence the effect of a merger on average airfares as the results are in line with previous studies that evaluated mergers between Network Legacy Carriers. Second, the results indicate a long-lasting increase in the average airfare emphasizing the impact of increased market concentration on multimarket contacts between the merged carrier and the competitors as a merger not only leads to increased market power, but also increases the number of routes where the merged entity will compete with other carriers. As Evans & Kessides (1994) argue, carriers prefer to avoid price wars on a given route for fear of retaliation by competitors on other contested routes, resulting in higher airfares and diminishing competition. Hence the findings of this study not only indicate the importance of assessing the competitive effects of a merger by focusing on the two merging carriers, but also suggest that antitrust policies by governments must consider each merger as an industry-wide dynamic due to the existence of multimarket contacts between the carriers. On the one hand further consolidation driven by mergers improves efficiencies for the carriers through economies of scale and scope by reducing costs and improving connectivity within the network with positive effects on customers. However, on the other hand reduced competition results in higher airfares due to increased multimarket contacts and market power, with the risk to generate dominant carriers with monopolistic behaviors such as the Lufthansa Group in Germany as assessed by Grosche et al. (2020) with negative implications on consumers resulting in welfare losses.

Appendix

Appendix A1: Expanded Route Network



Source: Transaction fact sheet, Alaska Airlines – Virgin America (2016)

Appendix A2: Detailed overview of U.S. Carriers distribution in the dataset by category

Airline Name	LCC	NLC	No Category	Regional	ULCC
Alaska Airlines	0	5,211	0	0	0
Allegiant Air	0	0	0	0	11,295
American Airlines	0	15,339	0	0	0
Delta Air Lines	0	13,732	0	0	0
Frontier Airlines	0	0	0	0	8,227
Hawaiian Airlines	0	0	934	0	0
Horizon Air	0	0	0	4	0
Island Air	0	0	0	20	0
Republic Airline	0	0	0	1	0
SkyWest Airlines	0	0	0	19	0
Southwest Airlines	49,809	0	0	0	0
Spirit Airlines	0	0	0	0	6,907
Sun Country Airlines	0	0	0	0	1,355
United Airlines	0	13,661	0	0	0
Virgin America	795	0	0	0	0
jetBlue Airways	5,713	0	0	0	0
Total	56,317	47,943	934	44	27,784

Appendix A3: Distribution by Carriers

Airline Name	Frequency	% Share
Alaska Airlines	5,211	3.92
Allegiant Air	11,295	8.49
American Airlines	15,339	11.53
Delta Air Lines	13,732	10.32
Frontier Airlines	8,227	6.18
Hawaiian Airlines	934	0.7
Horizon Air	4	0.00
Island Air	20	0.02
Republic Airline	1	0.00
SkyWest Airlines	19	0.01
Southwest Airlines	49,809	37.44
Spirit Airlines	6,907	5.19
Sun Country Airlines	1,355	1.02
United Airlines	13,661	10.27
Virgin America	795	0.60
jetBlue Airways	5,713	4.29
Total	133,022	100.00

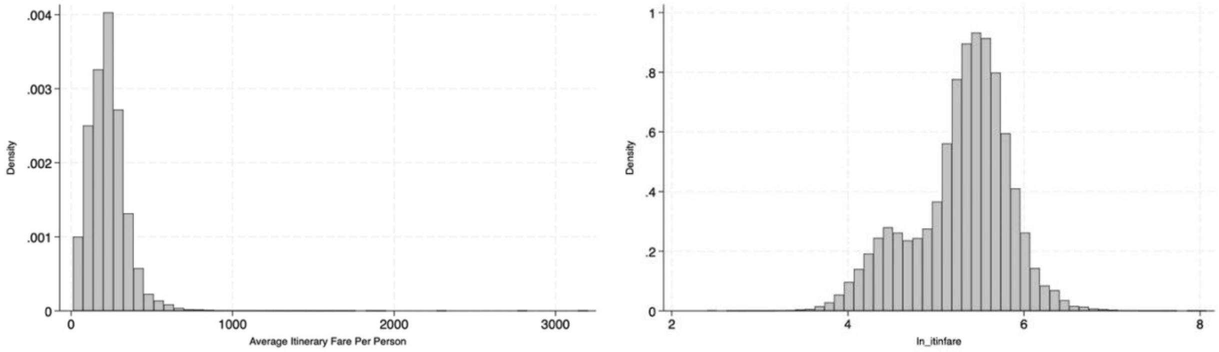
Appendix A4: Average airfare control and treated group for overlapping routes

Variable	Mean	Std. dev.
Treated Routes Average	264.68	0
Control Routes Average	220.93	0

Appendix A5: Average airfare control and treated group for non-overlapping routes

Variable	Mean	Std. dev.
Treated Routes Average	252.26	0
Control Routes Average	224.11	0

Appendix A6: Histogram of the dependent variable



Appendix A7: Overview of information[6] provided by dataset for selected route

year	quarter	apcarrier_id	origin	dest	opcarrier	Itinfare
2016	1	1247813204AA	JFK	MCO	AA	233.56

Appendix A8: Distribution U.S. Carriers by Category

Airline Category	Number of observations	% Share
Low-Cost Carrier	56,317	42.34
Network Legacy Carrier	47,943	36.04
Ultra-Low-Cost Carrier	27,784	20.89
No Category[7]	934	0.70
Regional	44	0.03
Total	133,022	100.000

[6] Table does not include all variables included in the dataset for each route

[7] Hawaiian Airlines was classified as "No Category" because they do not operate as a full NLC, nor as an LCC, and define themselves as a destination carrier (Aviation Strategy Ltd., 2023)

Appendix A9: Pairwise correlation of main variables in analysis of overlapping routes – H1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Airfare in Log	1.000								
(2) Treated Routes	0.137	1.000							
(3) Treated Period	-0.068	-0.007	1.000						
(4) Post & Merger	0.089	0.681	0.254	1.000					
(5) Carrier Category	-0.670	-0.061	0.057	-0.031	1.000				
(6) Airlines	0.147	-0.119	0.000	-0.106	-0.422	1.000			
(7) Year	-0.067	-0.008	0.893	0.226	0.059	-0.001	1.000		
(8) Quarter	-0.036	-0.006	0.003	-0.005	0.019	-0.003	0.003	1.000	
(9) AS VX Effect	0.067	0.402	0.150	0.590	-0.024	-0.230	0.133	-0.006	1.000

Appendix A10: Pairwise correlation of main variables in analysis of non-overlapping routes – H1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Airfare in Log	1.000								
(2) Treated Routes	0.089	1.000							
(3) Treated Period	-0.068	-0.003	1.000						
(4) Post & Merger	0.059	0.694	0.203	1.000					
(5) Carrier Category	-0.670	-0.042	0.057	-0.023	1.000				
(6) Airlines	0.147	-0.169	0.000	-0.121	-0.422	1.000			
(7) Year	-0.067	-0.003	0.893	0.181	0.059	-0.001	1.000		
(8) Quarter	-0.036	-0.004	0.003	-0.002	0.019	-0.003	0.003	1.000	
(9) AS VX Effect	0.067	0.370	0.150	0.542	-0.024	-0.230	0.133	-0.006	1.000

Appendix A11: Pairwise correlation of main variables in analysis of overlapping routes – H2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Airfare in Log	1.000											
(2) Treated Routes	0.137	1.000										
(3) Treated Period1	-0.026	0.000	1.000									
(4) Treated Period2	-0.051	-0.008	-0.330	1.000								
(5) Post & Merger1	0.051	0.411	0.322	-0.106	1.000							
(6) Post & Merger2	0.071	0.531	-0.097	0.293	-0.031	1.000						
(7) Carrier Category	-0.670	-0.061	0.013	0.051	-0.022	-0.021	1.000					
(8) Airlines	0.147	-0.119	0.001	0.000	-0.057	-0.087	-0.422	1.000				
(9) Year	-0.067	-0.008	0.207	0.784	0.067	0.230	0.059	-0.001	1.000			
(10) Quarter	-0.036	-0.006	-0.219	0.187	-0.072	0.051	0.019	-0.003	0.003	1.000		
(11) AS VX Effect1	0.038	0.246	0.193	-0.064	0.599	0.019	-0.018	-0.127	0.040	-0.046	1.000	
(12) AS VX Effect2	0.055	0.315	-0.057	0.174	0.018	0.594	-0.017	-0.192	0.137	0.029	-0.011	1.000

Appendix A12: Pairwise correlation of main variables in analysis of non-overlapping routes – H2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Airfare in Log	1.000											
(2) Treated Routes	0.089	1.000										
(3) Treated Period1	-0.026	0.001	1.000									
(4) Treated Period2	-0.051	-0.004	-0.330	1.000								
(5) Post & Merger1	0.032	0.421	0.259	-0.085	1.000							
(6) Post & Merger2	0.049	0.543	-0.078	0.236	-0.020	1.000						
(7) Carrier Category	-0.670	-0.042	0.013	0.051	-0.014	-0.018	1.000					
(8) Airlines	0.147	-0.169	0.001	0.000	-0.072	-0.096	-0.422	1.000				
(9) Year	-0.067	-0.003	0.207	0.784	0.054	0.185	0.059	-0.001	1.000			
(10) Quarter	-0.036	-0.004	-0.219	0.187	-0.056	0.041	0.019	-0.003	0.003	1.000		
(11) AS VX Effect1	0.038	0.220	0.193	-0.064	0.538	-0.015	-0.018	-0.127	0.040	-0.046	1.000	
(12) AS VX Effect2	0.055	0.295	-0.057	0.174	-0.015	0.554	-0.017	-0.192	0.137	0.029	-0.011	1.000

Appendix A13: Regression results overlapping routes for the main variables of interest – H1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treated_Routes	0.194***	0.218***	0.039***	0.039***	0.039***	0.039***	0.042***
	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
MergerEffect_Post	0.063***	0.083***	0.018***	0.018***	0.018***	0.018***	0.011
	(0.009)	(0.009)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
AS_VX_Effect_Post	-	-	-	-	-	-	0.021*
							(0.011)
U.S. Airlines	-	0.020***	-	-	-	-	-
		(0.000)					
U.S. Airlines Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes
Airline Category	-	-	-	0.135***	-	-	-
				(0.007)			
Airline Category Fixed Effects	No	No	No	No	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	No	No	No	No	No	Yes	Yes
Constant	5.258***	5.086***	5.468***	5.199***	5.334***	5.468***	5.457
	(0.002)	(0.003)	(0.006)	(0.010)	(0.004)	(0.006)	(0.008)
R-squared							
Within:	*0.019*	*0.047*	*0.618*	*0.618*	*0.618*	*0.618*	*0.618*
Between:	*0.520*	*0.399*	*0.891*	*0.891*	*0.891*	*0.891*	*0.891*
Overall:	*0.018*	*0.045*	*0.619*	*0.619*	*0.619*	*0.619*	*0.619*
Number of observations	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A14: Regression results non-overlapping routes for the main variables of interest – H1

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treated_Routes	0.147***	0.203***	-0.014***	-0.014***	-0.014***	-0.014***	-0.009
	(0.008)	(0.008)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
MergerEffect_Post	0.063***	0.066***	0.019***	0.019***	0.019***	0.019***	0.010
	(0.011)	(0.011)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
AS_VX_Effect_Post	-	-	-	-	-	-	0.023**
							(0.011)
U.S. Airlines	-	0.020***	-	-	-	-	-
		(0.000)					
U.S. Airlines Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes
Airline Category	-	-	-	0.182***	-	-	-
				(0.007)			
Airline Category Fixed Effects	No	No	No	No	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	No	No	No	No	No	Yes	Yes
Constant	5.271***	5.099***	5.520***	5.157***	5.339***	5.520***	5.507
	(0.002)	(0.003)	(0.006)	(0.011)	(0.004)	(0.006)	(0.009)
R-squared							
Within:	*0.008*	*0.036*	*0.617*	*0.617*	*0.617*	*0.617*	*0.617*
Between:	*0.584*	*0.324*	*0.892*	*0.892*	*0.892*	*0.892*	*0.892*
Overall:	*0.008*	*0.035*	*0.619*	*0.619*	*0.619*	*0.619*	*0.619*
Number of observations	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A15: Regression results for the main variables of interest for the routes where only one carrier operated in the pre-merger period – H1

	AS Non-Overlap		VX Non-Overlap	
Variable	(1)	(2)	(3)	(4)
Treated_Routes	-0.073**	-0.179***	0.088	0.242***
	(0.036)	(0.022)	(0.078)	(0.048)
MergerEffect_Post	0.119**	0.019	0.049	-0.014
	(0.051)	(0.032)	(0.114)	(0.071)
AS_VX_Effect_Post	-	0.031***	-	0.031***
		(0.009)		(0.009)
U.S. Airlines	-	-	-	-
U.S. Airlines Fixed Effects	No	Yes	No	Yes
Airline Category	-	-	-	-
Airline Category Fixed Effects	No	Yes	No	Yes
Interaction U.S. Airlines with Airline Category	No	Yes	No	Yes
Constant	5.286***	5.500***	5.285***	5.500
	(0.002)	(0.007)	(0.001)	(0.007)
R-squared				
Within:	*0.000*	*0.618*	*0.000*	*0.617*
Between:	*0.604*	*0.892*	*0.082*	*0.892*
Overall:	*0.000*	*0.619*	*0.000*	*0.619*
Number of observations	*133,022*	*133,022*	*133,022*	*133,022*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A16: Regression results overlapping routes for the main variables of interest – H2

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Treated_Routes	0.194***	0.218***	0.107***	0.039***	0.039***	0.042***
	(0.006)	(0.006)	(0.005)	(0.004)	(0.004)	(0.005)
MergerEffect_Post_Period1	0.046***	0.061***	0.021**	0.009	0.009	0.009
	(0.012)	(0.012)	(0.009)	(0.008)	(0.008)	(0.009)
MergerEffect_Post_Period2	0.074***	0.096***	0.040***	0.023***	0.023***	0.001
	(0.012)	(0.010)	(0.008)	(0.007)	(0.007)	(0.008)
AS_VX_Effect_Post_Period1	-	-	-	-	-	0.001
						(0.015)
AS_VX_Effect_Post_Period2	-	-	-	-	-	0.035***
						(0.013)
U.S. Airlines	-	0.020***	-0.018***	-	-	-
		(0.000)	(0.000)			
U.S. Airlines Fixed Effects	No	No	No	Yes	Yes	Yes
Airline Category	-	-	-0.265***	-	-	-
			(0.001)			
Airline Category Fixed Effects	No	No	No	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	No	No	No	No	Yes	Yes
Constant	5.258***	5.086***	6.006***	5.334***	5.468***	5.456***
	(0.002)	(0.003)	(0.004)	(0.004)	(0.006)	(0.008)
R-squared						
Within:	*0.019*	*0.047*	*0.475*	*0.618*	*0.618*	*0.618*
Between:	*0.537*	*0.419*	*0.824*	*0.893*	*0.893*	*0.893*
Overall:	*0.018*	*0.045*	*0.477*	*0.619*	*0.619*	*0.620*
Number of observations	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A17: Regression results non-overlapping routes for the main variables of interest – H2

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Treated_Routes	0.147***	0.203***	0.046***	-0.014***	-0.014***	-0.008
	(0.008)	(0.008)	(0.006)	(0.005)	(0.005)	(0.006)
MergerEffect_Post_Period1	0.040***	0.042***	0.025**	0.012	0.012	0.012
	(0.015)	(0.015)	(0.010)	(0.009)	(0.009)	(0.011)
MergerEffect_Post_Period2	0.077***	0.081***	0.043***	0.023***	0.023***	0.008
	(0.012)	(0.012)	(0.009)	(0.008)	(0.008)	(0.009)
AS_VX_Effect_Post_Period1	-	-	-	-	-	0.000
						(0.015)
AS_VX_Effect_Post_Period2	-	-	-	-	-	0.039***
						(0.013)
U.S. Airlines	-	0.020***	-0.019***	-	-	-
		(0.000)	(0.000)			
U.S. Airlines Fixed Effects	No	No	No	Yes	Yes	Yes
Airline Category	-	-	-0.267***	-	-	-
			(0.001)			
Airline Category Fixed Effects	No	No	No	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	No	No	No	No	Yes	Yes
Constant	5.257***	5.099***	6.027***	5.339***	5.520***	5.506***
	(0.002)	(0.003)	(0.004)	(0.004)	(0.006)	(0.008)
R-squared						
Within:	*0.008*	*0.036*	*0.471*	*0.617*	*0.617*	*0.617*
Between:	*0.565*	*0.334*	*0.825*	*0.892*	*0.892*	*0.892*
Overall:	*0.007*	*0.035*	*0.472*	*0.619*	*0.619*	*0.619*
Number of observations	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*	*133,022*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A18: Regression results for the main variables of interest for the routes where only one carrier operated in the pre-merger period – H2

	AS Non-Overlap		VX Non-Overlap	
Variable	(1)	(2)	(3)	(4)
Treated_Routes	-0.073**	-0.179***	0.088	0.242***
	(0.036)	(0.022)	(0.078)	(0.048)
MergerEffect_Post_Period1	0.095	0.015	0.029	-0.022
	(0.069)	(0.043)	(0.157)	(0.097)
MergerEffect_Post_Period2	0.134**	0.021	0.059	-0.009
	(0.059)	(0.037)	(0.131)	(0.081)
AS_VX_Effect_Post_Period1	-	0.009	-	0.009
		(0.012)		(0.012)
AS_VX_Effect_Post_Period2	-	0.046***	-	0.046***
		(0.011)		(0.11)
U.S. Airlines	-	-	-	-
U.S. Airlines Fixed Effects	No	Yes	No	Yes
Airline Category	-	-	-	-
Airline Category Fixed Effects	No	Yes	No	Yes
Interaction U.S. Airlines with Airline Category	No	Yes	No	Yes
Constant	5.286***	5.499***	5.285***	5.499***
	(0.002)	(0.007)	(0.001)	(0.007)
R-squared				
Within:	*0.000*	*0.618*	*0.000*	*0.617*
Between:	*0.613*	*0.893*	*0.095*	*0.893*
Overall:	*0.000*	*0.619*	*0.000*	*0.619*
Number of observations	*133,022*	*133,022*	*133,022*	*133,022*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A19: Regression results Robustness Check 1 – H1

	Overlapping Routes		Non-Overlapping Routes		AS Non-Overlap	VX Non-Overlap
Variable	(1)	(2)	(1)	(2)	(3)	(4)
Treated_Routes	0.029***	0.032***	-0.026***	-0.021***	-0.200***	0.244***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.023)	(0.048)
MergerEffect_Post	0.017***	0.011	0.017**	0.009	0.015	-0.017
	(0.006)	(0.007)	(0.007)	(0.008)	(0.033)	(0.070)
AS_VX_Effect_Post	-	0.018	-	0.019*	0.028***	0.028***
		(0.011)		(0.011)	(0.009)	(0.009)
U.S. Airlines Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Airline Category Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.478***	5.468***	5.531***	5.520***	5.502***	5.501***
	(0.006)	(0.006)	(0.006)	(0.002)	(0.007)	(0.007)
R-squared						
Within:	*0.622*	*0.622*	*0.622*	*0.622*	*0.622*	*0.622*
Between:	*0.888*	*0.888*	*0.888*	*0.888*	*0.888*	*0.888*
Overall:	*0.624*	*0.624*	*0.623*	*0.623*	*0.624*	*0.624*
Number of observations	*130,689*	*130,689*	*130,689*	*130,689*	*130,689*	*130,689*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A20: Regression results Robustness Check 1 – H2

	Overlapping Routes		Non-Overlapping Routes		AS Non-Overlap	VX Non-Overlap
Variable	(1)	(2)	(1)	(2)		
Treated_Routes	0.029***	0.032***	-0.026***	-0.021***	-0.200***	0.243***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.023)	(0.048)
MergerEffect_Post_Period1	0.006	0.005	0.009	0.009	0.007	-0.023
	(0.008)	(0.009)	(0.009)	(0.011)	(0.044)	(0.097)
MergerEffect_Post_Period2	0.024***	0.014*	0.021***	0.007	0.020	-0.014
	(0.007)	(0.008)	(0.008)	(0.011)	(0.038)	(0.081)
AS_VX_Effect_Post_Period1	-	0.004	-	-0.001	0.008	0.008
		(0.015)		(0.014)	(0.012)	(0.012)
AS_VX_Effect_Post_Period2	-	0.028**	-	0.033**	0.041***	0.041***
		(0.013)		(0.013)	(0.011)	(0.011)
U.S. Airlines Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Airline Category Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.478***	5.468***	5.531***	5.519***	5.502***	5.500***
	(0.006)	(0.008)	(0.006)	(0.009)	(0.007)	(0.007)
R-squared						
Within:	*0.622*	*0.622*	*0.622*	*0.622*	*0.622*	*0.622*
Between:	*0.890*	*0.890*	*0.889*	*0.890*	*0.890*	*0.890*
Overall:	*0.624*	*0.624*	*0.623*	*0.623*	*0.624*	*0.624*
Number of observations	*130,689*	*130,689*	*130,689*	*130,689*	*130,689*	*130,689*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A21: Regression results Robustness Check 2 – H1

	Overlapping Routes		Non-Overlapping Routes		AS Non-Overlap	VX Non-Overlap
Variable	(1)	(2)	(1)	(2)		
Treated_Routes	0.046***	0.050***	-0.005***	0.001	-0.159***	0.200***
	(0.005)	(0.006)	(0.006)	(0.007)	(0.025)	(0.057)
MergerEffect_Post	0.010	0.004	0.009	0.001	-0.002	0.030
	(0.006)	(0.007)	(0.007)	(0.009)	(0.034)	(0.077)
AS_VX_Effect_Post	-	0.018	-	0.022*	0.022**	0.022**
		(0.012)		(0.012)	(0.010)	(0.010)
U.S. Airlines Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Airline Category Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.478***	5.468***	5.531***	5.520***	5.505***	5.505***
	(0.006)	(0.006)	(0.006)	(0.002)	(0.008)	(0.008)
R-squared						
Within:	*0.626*	*0.626*	*0.626*	*0.626*	*0.626*	*0.626*
Between:	*0.870*	*0.870*	*0.870*	*0.871*	*0.871*	*0.871*
Overall:	*0.628*	*0.628*	*0.627*	*0.627*	*0.627*	*0.627*
Number of observations	*117,088*	*117,088*	*117,088*	*117,088*	*177,088*	*177,088*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A22: Regression results Robustness Check 2 – H2

	Overlapping Routes		Non-Overlapping Routes		AS Non-Overlap	VX Non-Overlap
Variable	(1)	(2)	(1)	(2)		
Treated_Routes	0.046***	0.050***	-0.005	0.001	-0.159***	0.200***
	(0.005)	(0.006)	(0.006)	(0.007)	(0.025)	(0.057)
MergerEffect_Post_Period1	0.001	0.002	0.002	0.003	-0.006	0.022
	(0.008)	(0.010)	(0.010)	(0.011)	(0.445)	(0.102)
MergerEffect_Post_Period2	0.016**	0.005	0.014*	-0.001	0.001	0.034
	(0.007)	(0.008)	(0.008)	(0.010)	(0.039)	(0.086)
AS_VX_Effect_Post_Period1	-	-0.001	-	-0.001	0.000	0.001
		(0.016)		(0.015)	(0.013)	(0.013)
AS_VX_Effect_Post_Period2	-	0.032**	-	0.038**	0.036***	0.036***
		(0.014)		(0.014)	(0.011)	(0.011)
U.S. Airlines Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Airline Category Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.466***	5.454***	5.518***	5.502***	5.504***	5.504***
	(0.006)	(0.010)	(0.006)	(0.010)	(0.008)	(0.008)
R-squared						
Within:	*0.626*	*0.626*	*0.626*	*0.626*	*0.626*	*0.626*
Between:	*0.871*	*0.871*	*0.871*	*0.872*	*0.872*	*0.872*
Overall:	*0.628*	*0.628*	*0.627*	*0.627*	*0.627*	*0.627*
Number of observations	*117,088*	*117,088*	*117,088*	*117,088*	*177,088*	*177,088*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A23: Regression results Robustness Check 3 – H1

	Overlapping Routes		Non-Overlapping Routes		AS Non-Overlap	VX Non-Overlap
Variable	(1)	(2)	(1)	(2)		
Treated_Routes	0.037***	0.042***	-0.015***	-0.008	-0.177***	0.236***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.022)	(0.049)
MergerEffect_Post	0.025***	0.012	0.024***	0.006	0.020	-0.010
	(0.007)	(0.008)	(0.008)	(0.010)	(0.039)	(0.089)
AS_VX_Effect_Post	-	0.039***	-	0.045***	0.050***	0.050***
		(0.014)		(0.014)	(0.012)	(0.011)
U.S. Airlines Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Airline Category Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.472***	5.457***	5.552***	5.506***	5.500***	5.499***
	(0.007)	(0.006)	(0.006)	(0.009)	(0.007)	(0.007)
R-squared						
Within:	*0.607*	*0.607*	*0.606*	*0.606*	*0.606*	*0.606*
Between:	*0.871*	*0.871*	*0.871*	*0.871*	*0.871*	*0.871*
Overall:	*0.608*	*0.608*	*0.608*	*0.608*	*0.608*	*0.608*
Number of observations	*99,351*	*99,351*	*99,351*	*99,351*	*99,351*	*99,351*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Appendix A24: Regression results Robustness Check 3 – H2

	Overlapping Routes		Non-Overlapping Routes		AS Non-Overlap	VX Non-Overlap
Variable	(1)	(2)	(1)	(2)		
Treated_Routes	0.037***	0.005***	-0.015***	-0.008	-0.177***	0.236***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.022)	(0.049)
MergerEffect_Post_Period1	-0.009	-0.031**	-0.007	-0.029*	-	-
	(0.012)	(0.015)	(0.015)	(0.018)		
MergerEffect_Post_Period2	0.036***	0.025***	0.033***	0.017	0.020	-0.010
	(0.008)	(0.009)	(0.009)	(0.011)	(0.039)	(0.089)
AS_VX_Effect_Post_Period1	-	0.064***	-	0.054**	-	-
		(0.024)		(0.023)		
AS_VX_Effect_Post_Period2	-	0.032**	-	0.042***	0.050***	0.050***
		(0.015)		(0.015)	(0.012)	(0.012)
U.S. Airlines Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Airline Category Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Interaction U.S. Airlines with Airline Category	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.472***	5.457***	5.525***	5.506***	5.500***	5.500***
	(0.006)	(0.009)	(0.007)	(0.009)	(0.007)	(0.007)
R-squared						
Within:	*0.607*	*0.607*	*0.606*	*0.606*	*0.606*	*0.606*
Between:	*0.877*	*0.877*	*0.874*	*0.874*	*0.871*	*0.871*
Overall:	*0.608*	*0.608*	*0.608*	*0.608*	*0.608*	*0.608*
Number of observations	*99,351*	*99,351*	*99,351*	*99,351*	*99,351*	*99,351*

Note: Standard errors can be found in parentheses.

*Significance is indicated as follows: *** for p<0.01; ** for p<0.05; * for p<0.1*

Bibliography

About | Sun Country Airlines. (n.d.). Retrieved June 29, 2023, from Sun Country Airlines. https://ir.suncountry.com/about/

Airlab. (2019, April 3). *Data Overview: The Origin and Destination Survey (DB1B)*. Retrieved June 26, 2023, from https://airlab.fiu.edu/data-overview-the-origin-and-destination-survey-db1b/

Airline Glossary. (n.d.). Retrieved June 26, 2023, from https://www.southwestairlinesinvestorrelations.com/investor-resources/investor-faqs/airline-glossary#:~:text=The%20percentage%20of%20a%20plane,paying%20passenger%20flown%20one%20mile.

Alaska Airlines. (2023). *Current Fleet*. Retrieved June 22, 2023, from https://news.alaskaair.com/current-fleet/

Alaska Airlines. (2023). *Alaska Airlines history*. Retrieved June 30, 2023 from https://www.alaskaair.com/content/about-us/history

Alaska Air Group. (2016). *Investor Alaska Air*. Retrieved June 28, 2023, from https://investor.alaskaair.com/news-releases/news-release-details/alaska-air-group-acquire-virgin-america-creating-west-coasts#

Alaska Airlines - Virgin America. (2016). *Transaction fact sheet.* Retrieved June 29, 2023, from https://news.alaskaair.com/wp-content/uploads/2016/04/transaction-fact-sheet.pdf

Aviation Strategy. (2023). Hawaiian Airlines: Asian expansion. *Aviation Strategy Ltd.* Retrieved June 27, 2023, from https://aviationstrategy.aero/newsletter/Aug-2010/4/Hawaiian-Airlines:Asian-expansion#:~:text=Neither%20a%20network%20carrier%20nor,to%20become%20more%20broadly%20based.

Bachwich, A. R., & Wittman, M. D. (2017). The emergence and effects of the ultra-low cost carrier (ULCC) business model in the U.S. airline industry. *Journal of Air Transport Management*, *62*, 155–164. https://doi.org/10.1016/j.jairtraman.2017.03.012

Baker, D. (2013). Service Quality and Customer Satisfaction in the Airline Industry: A Comparison between Legacy Airlines and Low-Cost Airlines. *American Journal of Tourism Research*, *2*(1). https://doi.org/10.11634/216837861302317

Barrows, S.D. (2018). After the Recent US Airline Mergers, Did Domestic Airfares Increase? *International Review of Management and Marketing*, *8*(1), 1-8.

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How Much Should We Trust Differences-In-Differences Estimates? *Quarterly Journal of Economics*, *119*(1), 249–275. https://doi.org/10.1162/003355304772839588

Blalock, G., Kadiyali, V., & Simon, D. I. (2007). The Impact of Post-9/11 Airport Security Measures on the Demand for Air Travel. *The Journal of Law and Economics*, *50*(4), 731–755. https://doi.org/10.1086/519816

Bloningen, B. A. , & Pierce, J. R. (2015). The effect of mergers and acquisitions on market power and efficiency. *Finance and Economics Discussion Series 2016-083. Washington: Board of Governors of the Federal Reserve System.*

Borenstein, S. (1989). Hubs and High Fares: Dominance and Market Power in the U.S. Airline Industry. *The RAND Journal of Economics*, *20*(3), 344. https://doi.org/10.2307/2555575

Borenstein, Severin (1990). Airline Mergers, Airport Dominance, and Market Power. *The American Economic Review*, *80*(2), 400-404

Brown, J. M. (2014). Jimmy Carter, Alfred Kahn, and Airline Deregulation: Anatomy of a Policy Success. *The Independent Review, 19*(1), 1–15. https://digitalcommons.georgiasouthern.edu/econ-facpubs/80/

Budd, L., & Ison, S. (2020). *Air Transport Management: An International Perspective*.

CAPA - Centre for Aviation. (2022, May 9). *CAPA*. Retrieved June 27, 2023, from Sun Country Airlines proves its business model has staying power: https://centreforaviation.com/analysis/reports/sun-country-airlines-proves-its-business-model-has-staying-power-607316

Carlton, D. W., Israel, M., MacSwain, I., & Orlov, E. (2019). Are legacy airline mergers pro- or anti-competitive? Evidence from recent U.S. airline mergers. *International Journal of Industrial Organization*, *62*, 58–95. https://doi.org/10.1016/j.ijindorg.2017.12.002

Cook, G., & Goodwin, J. L. R. (2008). Airline Networks: A Comparison of Hub-and-Spoke and Point-to-Point Systems. *The Journal of Aviation/Aerospace Education & Research*. https://doi.org/10.15394/jaaer.2008.1443

Crail, C. (2022, September 28). What Is An Airline Alliance? *Forbes Advisor*. Retrieved July 1, 2023, from https://www.forbes.com/advisor/credit-cards/travel-rewards/what-is-an-airline-alliance/

Crain, A. (2007). Ford, Carter, and Deregulation in the 1970s. *J. Telecommun. High Technol. Law*, *5*, 413–448. http://www.jthtl.org/content/articles/V5I2/JTHTLv5i2_Crain.PDF

Difference-in-Difference Estimation. (2023, March 13). Columbia University Mailman School of Public Health. https://www.publichealth.columbia.edu/research/population-health-methods/difference-difference-estimation

Eckbo, B. E. (1983). Horizontal mergers, collusion, and stockholder wealth. *Journal of Financial Economics*, *11*(1–4), 241–273. https://doi.org/10.1016/0304-405x(83)90013-2

Eckbo, B. E. (1985). Mergers and the Market Concentration Doctrine: Evidence from the Capital Market. *The Journal of Business*, *58*(3), 325. https://doi.org/10.1086/296300

Edwards, C. (1955). Conglomerate Bigness as a Source of Power. In *Business concentration and Price Policy. Princeton, NJ: Princeton University Press*, 331-359.

Evans, W., & Kessides, I. (1994). Living by the "Golden Rule": Multimarket Contact in the U.S. Airline Industry. *The Quarterly Journal of Economics 109*, 341-366.

Francis, G., Humphreys, I. R., Ison, S., & Aicken, M. (2006). Where next for low cost airlines? A spatial and temporal comparative study. *Journal of Transport Geography*, *14*(2), 83–94. https://doi.org/10.1016/j.jtrangeo.2005.05.005

Garrow, L. A., & Lurkin, V. (2021). How COVID-19 is impacting and reshaping the airline industry. *Journal of Revenue and Pricing Management*, *20*(1), 3–9. https://doi.org/10.1057/s41272-020-00271-1

Goetz, A. R., & Vowles, T. M. (2009). The good, the bad, and the ugly: 30 years of US airline deregulation. *Journal of Transport Geography*, *17*(4), 251–263. https://doi.org/10.1016/j.jtrangeo.2009.02.012

Goetz, C. G., & Shapiro, A. H. (2012). Strategic alliance as a response to the threat of entry: Evidence from airline codesharing. *International Journal of Industrial Organization*, *30*(6), 735–747. https://doi.org/10.1016/j.ijindorg.2012.08.003

Grosche, T., Klophaus, R., & Seredyński, A. (2020). Market concentration in German air transport before and after the Air Berlin bankruptcy. *Transport Policy*, *94*, 78–88. https://doi.org/10.1016/j.tranpol.2020.05.006

Gugler, K., Mueller, D. C., Yurtoglu, B. B., & Zulehner, C. (2003). The effects of mergers: an international comparison. *International Journal of Industrial Organization*, *21*(5), 625–653. https://doi.org/10.1016/s0167-7187(02)00107-8

Heyer, K., Shapiro, C., & Wilder, J. M. (2009). The Year in Review: Economics at the Antitrust Division, 2008–2009. *Review of Industrial Organization*, *35*(4), 349–367. https://doi.org/10.1007/s11151-009-9232-1

Hüschelrath, K., & Müller, K. (2014). Market Power, Efficiencies, and Entry Evidence from an Airline Merger. *Managerial and Decision Economics*, *36*(4), 239–255. https://doi.org/10.1002/mde.2664

Imai, K., & Kim, I. Y. (2019). When Should We Use Unit Fixed Effects Regression Models for Causal Inference with Longitudinal Data? *American Journal of Political Science, 63*(2), 467–490. https://doi.org/10.1111/ajps.12417

Jain, V. (2015). What did the Wave Bring?: Short-Term Price Effect of the US Airline Merger Wave (2009-2012). *Journal of Economic Policy and Research*, *10*(2), 49-68.

jetBlue. (2023). *jetBlue Newsroom*. Retrieved June 30, 2023, from https://news.jetblue.com/search-results/?SearchTerm=spirit+airlines

Kim, E., & Singal, V. (1993). Mergers and Market Power: Evidence from the Airline Industry. *The American Economic Review*, 549-569.

Kwoka, J., & Shumilkina, E. (2010). THE PRICE EFFECT OF ELIMINATING POTENTIAL COMPETITION: EVIDENCE FROM AN AIRLINE MERGER*. *Journal of Industrial Economics*, *58*(4), 767–793. https://doi.org/10.1111/j.1467-6451.2010.00433.x

Le, H. (2016). An Empirical Analysis of the Price and Output Effects of the Southwest/Airtran Merger. *Competition and Regulation in Network Industries*, *17*(3–4), 226–240. https://doi.org/10.1177/178359171601700302

Luo, D. (2013). The Price Effects of the Delta/Northwest Airline Merger. *Review of Industrial Organization*, *44*(1), 27–48. https://doi.org/10.1007/s11151-013-9380-1

Mason, K. O., & Morrison, W. H. (2008). Towards a means of consistently comparing airline business models with an application to the 'low cost' airline sector. *Research in Transportation Economics*, *24*(1), 75–84. https://doi.org/10.1016/j.retrec.2009.01.006

Moore, T. A. (1986). U. S. Airline Deregulation: Its Effects on Passengers, Capital, and Labor. *The Journal of Law and Economics*, *29*(1), 1–28. https://doi.org/10.1086/467107

Njoya, E. T., & Niemeier, H. (2011). Do dedicated low-cost passenger terminals create competitive advantages for airports? *Research in Transportation Business and Management*, *1*(1), 55–61. https://doi.org/10.1016/j.rtbm.2011.06.005

oneworld. (2023). *oneworld Member Airlines*. Retrieved June 25, 2023, from https://www.oneworld.com/members

Princeton University. (2015). Retrieved June 21, 2023, from https://www.princeton.edu/~otorres/DID101.pdf

Rubiano-Matulevich, E. (2021). Essays on conflict-induced displacement and gender in Colombia. *Essays on conflict-induced displacement and gender in Colombia*. Maastricht University. Retrieved from Maastricht University - Doctoral Thesis: https://cris.maastrichtuniversity.nl/ws/portalfiles/portal/64739846/c7110.pdf

Statista. (2022, April). *Low-cost carrier market worldwide - statistics & facts*. Retrieved June 29, 2023, from https://www.statista.com/topics/6024/low-cost-carrier-market-worldwide/#topicOverview

SkyWest Airlines. (2022, June 30). *SkyWest Airlines Fact Sheet*. Retrieved June 28, 2023, from https://files-skywest-com.s3.us-west-2.amazonaws.com/public/Uploads/Documents/MediaKit/August-2022-Media-Kit/SkyWest-Fact-Sheet.pdf

Vermeersch, C. (2007, March). *The World Bank.* Retrieved June 29, 2023, from https://thedocs.worldbank.org/en/doc/943461526315027890-0090022018/original/DifferenceInDifferenceCairoEnglish.pdf

Werden, G. J., Joskow, A. S., & Johnson, R. J. (1991). The effects of mergers on price and output: Two case studies from the airline industry. *Managerial and Decision Economics, 12*(5), 341–352. https://doi.org/10.1002/mde.4090120502

West, R. (2022). Best practice in statistics: The use of log tranformation. *Annals of Clinical Biochemistry: International Journal of Laboratory Medicine 59(3)*, 162-165.

Windle, R. J., & Dresner, M. (1999). Competitive responses to low cost carrier entry. *Transportation Research Part E-logistics and Transportation Review*, *35*(1), 59–75. https://doi.org/10.1016/s1366-5545(98)00025-8

Zuidberg, J. (2019). Network geographies and financial performances in low-cost carrier versus network carrier competition: The case of Norwegian versus SAS. *Journal of Transport Geography*, *79*, 102462. https://doi.org/10.1016/j.jtrangeo.2019.102462