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Abstract

The antitrust authorities have to analyze the impact of the upcoming merger in a most extensive and precise way while being limited in time. One of the used methods of antitrust analysis is merger simulation. When the mergers of big companies are considered, it is difficult to examine all markets to assess the overall merger effect. This thesis proposes an approach, that allows simulating the net merger effect in the very beginning of an investigation to screen out problematic mergers and obtain quantitative predictions of the impact. The thesis also conducts a real case merger simulation, to compare the predicted results to actual and make conclusions about the applicability and further usage of the proposed approach.

Keywords: markets and competition, merger simulation, price analysis, antitrust investigations

Zusammenfassung

Die Kartellaufsichtsbehörde muss in kürzerster Zeit die möglichen Auswirkung von geplannten Unternehmenszusammenschlüssen umfassend und präzise untersuchen und beurteilen. Einer ihrer Methoden ist die Simulation der Fusion. Wenn es aber zu einem Zusammenschluss von großen Unternehmen kommt, ist es schwierig die gesamten Auswirkungen auf allen Märkten, auf denen diese agieren, zu beurteilen. Diese Masterarbeit untersucht eine Herangehensweise, welche den netto Effekt eines Zusammenschlusses am Anfang einer Untersuchung simuliert und quantitative Vorhersagen über die Auswirkungen gibt. Es werden anhand einer tatsächlich stattgefundenen Fusion die Vorhersagen dieser Methode untersucht. Die Ergebnisse der Simulationen und die tatsächlichen Auswirkungen nach der Fusion werden verglichen und daraus werden Schlüsse über die Eignung der vorgeschlagenen Methode gezogen.

Schlagwörter: Wettbewerbspolitik, Kartellaufsichtsbehörde, Wettbewerbsbehörde, Simulationsmodelle in der Fusionskontrolle, Fusionskontrolle, Preis-Analyse

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Contents

1. Introduction

Horizontal mergers and acquisitions have a significant effect on different aspects of economical activity in any country. The most sensitive factors to a merger are competitiveness level on the market, where the deal takes place and welfare of the consumers. Antitrust authorities study those factors to assess the impact and possible negative effects. If there are considerable threats for the competitiveness or consumer welfare losses predicted, the antitrust authority has the right to forbid the deal. However, if there are also notable positive economical effects besides the negative consequences of a merger, the authority might accept it, possibly with a list of conditions that will neutralize the negative effects.

Antitrust authorities' investigators use a set of techniques to determine when anticompetitive problems may arise from horizontal mergers. They have to consider every market where merged entity operates to observe the net impact of the deal. Since decision has to be done in a tight time frame, in cases when merging companies are of big size and compete on a great amount of markets, it is a time-consuming challenge to consider every market and conduct a non-biased investigation. Therefore, investigations sometimes focus on details and particular markets, thus the aggregated merger effect moves out of the scope.

The subject of this research is a merger of AMR Corporation and US Airways Group that took place in 2013-2015, was investigated by the US Department of Justice (DOJ) and formed the largest airline in the world, that operates on 96 domestic routes. Consideration of every route as a separate market needs a great amount of time, which investigators usually do not have. Having an approach that allows promptly quantifying the net effect of a merger on all markets might be a useful screening tool for antitrust authorities.

This work aims to propose and test a screening instrument that quantifies merger effects on prices and presumes usage of the different metrics than in other researches in this field. Unlike studies that are mainly focused on particular routes and areas of the country, here we will consider an aggregate country level output of the airlines. The collected data consists of revenue passenger miles (number of passengers multiplied by miles they flown, RPM) in the whole domestic segment in the U.S. to determine the market shares and yields per passenger miles (average prices per mile flown) as prices. Such data allows conducting a merger simulation and observing the net result of a merger on prices in the whole domestic U.S. air transportation market.

The work of Werden and Froeb (1994) was followed to estimate the demand system and work of Hausman et al. (1994) was followed to simulate the merger and quantify the price increase for the two merging firms. The predicted results were compared to the actual figures in the year 2014, when the firms already merged and operated under separate brand names to test and validate the approach. Finally, conclusions concerning the precision of the approach and the perspective of further usage were made.

Apart from the official DOJ investigation, to our best knowledge, there are no available works about AMR – US Airways merger that would have conducted a merger simulation and quantified the impact on consumers' welfare through prices analysis.

The work is structured in a way that allows obtaining the desired results and settled aims. In the first part we consider framework of the antitrust investigations, methods that are applied and discuss advantages and disadvantages of them (Chapter 2). In the second part we review literature concerning mergers in the airline industry and choose an appropriate method (Chapters 3, 4). In the third part, we apply the chosen method, estimate the demand model, conduct a simulation, obtain results, compare them to real figures and make conclusions concerning the applied method (Chapters 5, 6, 7).

2. Theory of merger simulations

2.1. Unilateral effects prediction

The antitrust investigations are regulated by section 7 of the Clayton Act that prohibits a merger if:

"In any line of commerce or in any activity affecting commerce in any section of the country, the effect of an acquisition may be substantially to lessen competition, or tend to create a monopoly."

The central question of the analysis is whether a merger will lessen the competition or tend to create a monopoly. Lessening competition allows companies to execute market power, harming customers as a result of decreased constraints or incentives. Elimination of competition between products of the merging firms allows the merged entity to unilaterally abuse market power (by raising prices, reducing output, diminishing innovations etc.). Such adverse consequences are called unilateral effects or non-coordinated effects and are mainly subject of investigations in terms of prices.

Building market models to simulate and predict unilateral effects of mergers is a very useful tool that has grown in popularity during the 1990s with appearance of the papers by Werden and Froeb (1994) and Hausman et al. (1994).

Simulations might be used for two main purposes. First, they provide screening and even with a rough approximation are at least as good as the use of market shares and concentration indices and therefore are a good complementary screening tool for these methods. Secondly, with well-defined and realistic models, merger simulations pursue the goal to ensure a "best guess" prediction for the likely effects of a merger.

Although merger simulation is now familiar to most antitrust economists and has been applied to a number of investigated cases, authorities remain cautious in the use of the results of these simulations as evidence. One of the reasons is that since there is usually considerable uncertainty regarding the price-setting mechanism in the market and the nature of demand, the model builder must make explicit assumptions about each of these significant components of a simulation process.

Simulation is a useful tool, however, it should not be considered as an ultimate approach or to the exclusion of other possible analyses. Methods of merger simulation should be considered in line with other tools to yield the most accurate results.

2.2. Methods of merger simulation

The most basic approach, which was mentioned in the 1992 Merger Guidelines, mostly relied on market definition and the calculation of the Herfindahl-Hirschman Index (HHI). The HHI is the sum of squared market shares ($\sum s_i^2$), where market share is between 0 and 100. The value of the index is between zero and ten thousand, where ten thousand represents a monopoly market. The U.S. Department of Justice (2016 version) considers market as "moderately concentrated" if the HHI is between 1500 and 2500, "highly concentrated" if the HHI is above 2500. This approach may not screen out the problematic mergers and provides a sketchy assessment of the impact. However, it is very easily applicable and therefore is still used by antitrust investigators.

Another method is called the "UPP" or Upwards Pricing Pressure method (Shapiro (1996)) and included in the 2010 Merger Guidelines. The approach uses a so called "diversion ratio", which is defined as the fraction of unit sales lost by the first product due to an increase in its price that would be diverted to the second product after the merger. Despite being an important improvement in comparison to the HHI approach, it has several drawbacks. First of all, the analysis is based on the effect of the merger on only one product at a time and does not consider the impact on both products, however in reality both prices are likely to change simultaneously. Moreover, to obtain the price difference between post-merger and pre-merger price, the investigator has to make assumptions about demand curvature that induces the rate at which marginal cost changes transfer into price changes. Antitrust practitioners either have reasonable estimates on these parameters, or they have to consider methods, assuming different underlying demand systems (that impose demand curvature).

This important group of methods provides quantitative predictions of the price increase. The antitrust economist relies on assumptions regarding the demand and then takes as a starting point an equilibrium pricing, calibrates the demand model to the available industry data and uses the model to predict post-merger changes. These predictions are applicable in the short-term, when a new entry is not expected and the rate of product development and innovation is not considered.

The analysis is conducted in two stages: the first stage is the estimation of a demand model and the second stage is the merger simulation itself, where the model builder quantifies the price increase.

A major part of the process is to choose an appropriate demand model for a merger simulation. The most used models are: the Antitrust Logit Model or "ALM" (Werden and Froeb (1994)) and the Almost Ideal Demand System or "AIDS" (Deaton and Muellbauer (1980)). Both demand system models are based on the Bertrand pricing assumption, which explains firms have market power because of product differentiation.

AIDS is explained as a first-order approximation of any demand system. If we take a great number of consumers behaving as predicted by an AIDS and aggregate their demands, the result will be the Almost Ideal Demand System itself. The model states that the share of each good equals a linear function of the logarithms of prices of every good on the market. It is expressed as: $s_i = a_i + \sum b_{ij} \ln(p_j) + h_i \ln(\frac{x}{P})$, j=1,…,N, where x is the total market expenditure, P is a price index, p_j is price, s_i are market shares, a_i, b_{ij}, h_i are estimated parameters.

Market shares are expressed as revenue shares. The model requires detailed price and revenue information and does not have serious assumptions concerning the form of demand and substitution patterns, however it is structurally complex and requires estimation of a large number (N^2 when there are N goods on the market) of coefficients, which can lead to additional difficulties in the econometric part of the research (e.g. ensuring plausible sign convention for cross and own-price elasticities). Even with scanner datasets, the estimation of such system may be infeasible or the results may not be reliable.

The problem connected with the estimation of a high number of coefficients might be resolved by parameter reduction in a demand system. The ALM has a great reduction of unknown parameters in comparison to AIDS. The ALM is a common logit model redesigned for usage by antitrust practitioners. As a tradeoff for reduction of coefficients, the model relies on an assumption concerning the cross-price elasticities of the goods. In particular, it states that the cross-price elasticities with respect to the price of any other good are the same ($\eta_{ij} = \eta_{kj}$). This assumption is called the Independence of Irrelevant Alternatives or "IIA" property.

Particularly, it means that if we have to choose from three goods: 1, 2 and 3, with market shares of 55%, 30% and 15% respectively, then if the price of good 3 rises, then the lost demand from good 3 will go to goods 1 and 2 in proportion 55/30 respectively. With N goods on the market, the demand system with "IIA" has 2N parameters to estimate, in comparison to N^2 required by the unrestricted demand system.

According to Davis and Garcés (2010), one of the crucial properties of the "IIA", is that it might yield unreasonable predictions about what will happen on the market in case of a new entry. Hausman (2010) confirms, that "IIA" overestimates the consumer surplus in case of a new good introduction. Moreover, "IIA" might not be a reasonable assumption, since substitution patterns are drawn with accordance to the market shares, when there are goods that are not close substitutes. "IIA" leads to more biased results and overestimates elasticity (as any demand model) when there is a small number of companies and some products have much bigger shares than others. Davis and Wilson (2003) point out, that on the one hand ALM is a suitable tool for screening problematic mergers, on the other hand the price predictions might deviate from the actual ones. However, all researches admit that introduction of "nests" will relax the "IIA" assumption and lead to more consistent results. Nests are groups of products on the market that are more close substitutes to each other.

Summarizing the studied methods, we see that theoretically more sophisticated and time-consuming methods should yield more accurate and precise results. However, in reality the choice of the unrestricted demand system does not guarantee precise results. Therefore, in case when the "IIA" property holds approximately or there is no contradictory evidence, usage of a model that relies on this property could be a good choice.

3. U.S. Passenger airline industry

3.1. Market overview

The U.S. domestic air industry is ruled by 12 companies that at the moment of the merger account for almost 90% of the total market share. For the last 20 years, the industry was shaped by mergers and acquisitions of different size. From the early 1990s many of the big players announced bankruptcy or were acquired by other companies (for example Pan Am, Eastern, TWA).

Table 1 represents the market shares of the companies: the revenue shares are in the second column, and the RPM shares are the quantity shares. We see, that the revenue market shares and the quantity market shares have close values to each other for the merging companies: 13,2% and 12,6% for AMA (American Airlines); 8,8% and 8,5% for USA (US Airways).

Company	Revenue Share	RPM share	Fleet size
AMA	13,2%	12,6%	612
USA	8,8%	8,5%	287
UNI	15,0%	15,7%	698
SWT	20,0%	17,8%	601
JBL	4,9%	5,1%	185
FRO	1,3%	1,6%	53
VAM	1,5%	1,7%	46
ALA	3,8%	4,0%	128
HAW	1,6%	1,6%	45
SPI	1,1%	2,0%	51
ALL	0,8%	1,1%	63
DEL	17,7%	16,0%	715
Outside	10,1%	12,2%	n/a

Table 1. Key metrics of major U.S. airlines. Airline codes can be found in Appendix point 1.

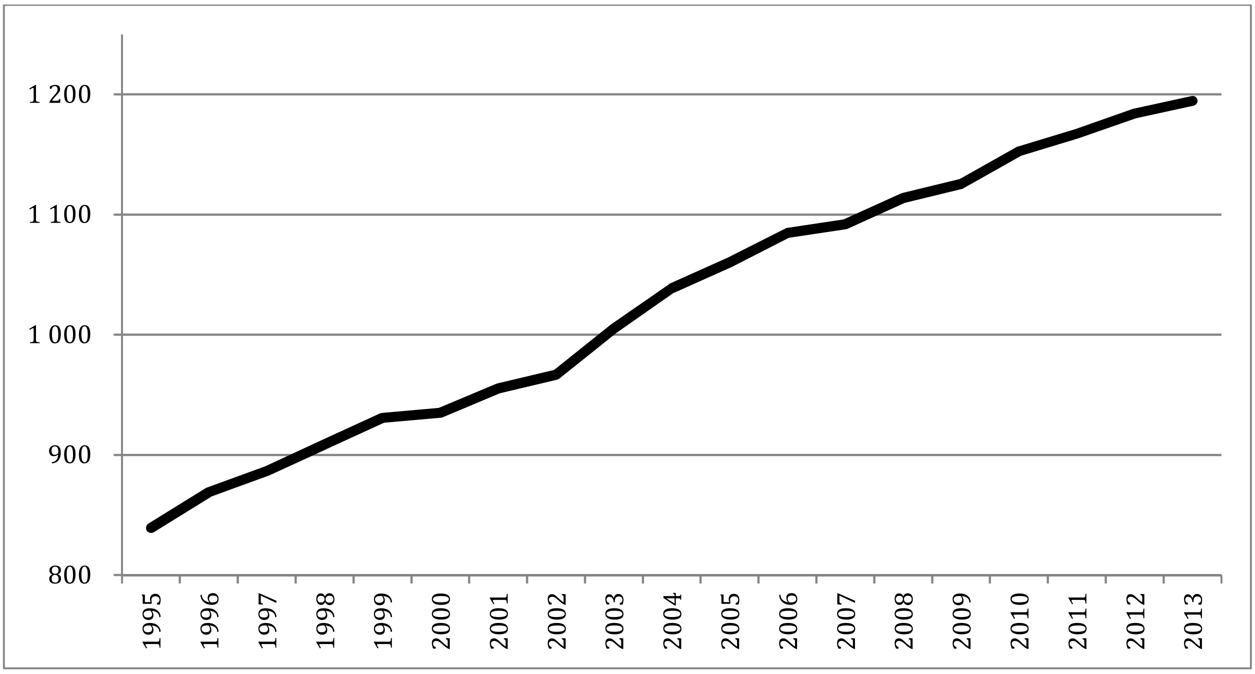
The airline industry in the United States is a separate market; industry participants do not compete with such means of transport as train or bus. Unlike in Europe, where distances are smaller and there are plenty of various high-speed trains, in the United States the major high speed transport is an airplane and there is not much competition between these means of transport.

Table 2 represents percent of trips depending on distance of the trip. Air transport trips share develops from 1,6% for a trip between 50 and 499 miles to 82,1% for a trip of 1500 miles and more. The personal vehicle, on opposite, loses the market share from 95,4% for a 50-499 miles trip to 14,8% for a more than 1500 miles trip. Since personal vehicles belong to consumers, we do not consider them as a substitute for the air transport. The market share of the bus and the train never exceeds 3,3% and corresponds to 1,5% and 0,7% when the trip is more than 1000 miles. Therefore, we could make an assumption that even in the case of a substantial price increase for some of the brands operating in the airline industry, the consumers will unlikely switch to the land transport, which is especially relevant for the distances over 1000 miles. Thus, the consumers will have to search alternatives among other airways.

Transport/ Distance	50-499 miles	Std. Err.	500-749 miles	Std. Err.	750-999 miles	Std. Err.	1,000-1,499 miles	Std. Err.	1,500+ miles	Std. Err.
Personal vehicle	95,4	0,22	61,8	2,31	42,3	3,32	31,5	2,66	14,8	1,61
Air	1,6	0,11	33,7	2,36	55,2	3,26	65,6	2,58	82,1	1,95
Bus	2,1	0,13	*3,3*	0,96	1,5	0,49	1,5	0,56	1,4	0,65
Train	0,8	0,12	1	0,83	0,9	0,22	0,7	0,52	0,8	0,42
Other	0,2	0,06	*0,1*	0,08	0,1	0,09	0,7	0,36	1	0,32

Table 2. Percent of trips by transport depending on distance.

The average flight distance is close to 1000 miles and differs for various airlines. Graph 1 represents a clear trend of increasing the average flight length, which rallied from the level of 800 miles in 1995 to above 1100 miles in 2013.



Graph 1. Average flight distance in miles.

Two types of carriers operate on the airline market: full-service carriers and low-cost carriers. A full-service carrier (FSC) is an airline in a normal understanding. It offers a wide range of service for different clients, making emphasis on comfort, service level and other options that could be represented as a competitive advantage. A low-cost carrier (LCC) is an airline that is designed to have a competitive advantage in terms of costs over a FSC that leads to lower prices. The cost reduction might be reached by concentration only on core business, offering online registration to reduce the number of counters at the airport, having a single type aircraft fleet (e.g. all planes of Southwest Airlines are

Boeing-737), having no lounge areas access in the airport etc. However, if we consider an economy class on the domestic market, where an average flight takes 1-2 hours, the difference between FSC and LCC becomes minor. In fact, on short-term distances all companies operate very similar aircraft types (small narrowbodies) with a comparable configuration (i.e. space between the seats), the basic options as baggage drop-off and meal onboard might be also available for the LCC. We could conclude that LCC and FSC companies both offer a close level of service on domestic economy class flights and therefore could be considered as close substitutes to each other.

3.2. Deal overview

In February 2013, American Airlines and US Airways announced plans to merge. The combined airline became the largest in United States and, by some metrics, in the world. The companies kept the original branding for 2014, and from October 2015 the merged companies operate under the American Airlines name. The companies claimed that the merger would yield more than 1,5 billion a year in added revenue and cost savings.

The merger was actively investigated by the United States Department of Justice and initially blocked. However, later the merger case was reconsidered and the deal was allowed.

Apart from antitrust authorities' investigation, the deal was analyzed in some works. However, none of the works conducted a merger simulation to quantify how changed level of competition on the market impacted prices that consumers pay. Correia (2015) estimates the final equity value of the merged company and the magnitude of financial synergies of the merger, not taking into account the welfare of the consumers and competition on the market. Dalkir and Hearle (2014) analyzed how the stock returns behaved after the merger was allowed. Bolte (2014), Drocton (2014) analyzed the impact of the deal on the industry, taking into account the DOJ's decision without making quantitative predictions.

3.3. Overview of previous studies in airline industry

Kim and Singal (1993) studied 14 mergers of airlines that took place in 1985-1988 to find how they affected the ticket prices. There researchers considered the prices for routes where companies involved in mergers operated in comparison with routes of comparable size, where those companies did not operate. The findings indicate that deals resulted in higher prices – 9,44% price increase in comparison to routes where no mergers occurred. Moreover, surprisingly, the competitors of the merged entities increased their prices even more – on 12,17% in comparison to routes without mergers. Additionally, the authors noted that companies abused the market power more on a longer distance flights – the prices were higher there.

The research of Borenstein (1990) covered 2 mergers in the United States at the end of 1986: merger of Northwest Airlines and Republic Airlines and acquisition of Ozark Airlines by Trans World Airlines. The author has found evidence of exercising of market power, which was expressed in substantial prices increase – around 9,5%. Moreover, the price increase was presented not only on the routes where both of the companies operated, but also on the routes where only one of the merging companies was present and the market share did not change. Besides, the change in prices usually occurred before the deal, at the stage of negotiations.

Anderson et al. (2005) conducted research about the changes in the U.S. market industry since it's deregulation. The work covers the period of mergers, growth in the number of air passengers, and entry of the low-cost carriers. The authors introduce an econometric model of domestic air fares to find out how the changes affected prices on a particular route or at an airport. The findings show that airfares decreased in the U.S. generally because of the restructuring. Though, the authors admit an adverse effect, when a carrier charges a price premium on the traffic from its main hubs.

Moss (2013) from the American Antitrust Institute discussed the claimed efficiencies of the mergers and compared them to actual ones. The author tried to separate cost efficiencies in marginal costs that are transferred to consumers in the form of lower prices from the reductions in fixed costs that enlarge profits and take more time to “leak” to customers. She finds out that mostly the mergers deliver efficiencies in terms of fixed costs. Moreover, she states that the magnitude of the efficiencies in airlines mergers should be considered with extreme skepticism. These findings suggest that the size of the assumed marginal costs reduction should be minor.

Summarizing, we see that the findings of different works have conflicting results. It could be explained because all the works in this area considered particular or several routes. What is more, in the vast majority of considered mergers a middle-sized company acquired a small local player. In such cases the merged company may be a possible threat for the welfare of customers only on the level of a particular route. Even in case when a merged company is a big player on several routes, such analysis is a useful tool. However, in case of deals where market leaders take part, it will be problematic to consider all routes.

The merging companies in our case operate on 96 domestic destinations. This means that to observe the net effect of a merger, an investigator should spend much time on analyzing every route separately. Since investigations are usually restricted in time, antitrust practitioners need to screen out problematic mergers and understand the magnitude of the impact on prices quite quickly. This could be done by checking whether the merger’s adverse effects outweigh the claimed efficiencies (if there are any). Observing the aggregate impact of a deal on prices, an economist may continue research on particular paths if a more detailed result is needed.

4. Method

4.1. Choice of the model

As was mentioned before, the choice of an appropriate model is crucial in a merger simulation. What is more, it is important to realize the limitations of the specific chosen method and merger simulation techniques in general. Additionally, an antitrust economist should keep in mind that he should find a certain tradeoff between model complexity and precision of the results.

The HHI is a very simple approach and hardly can be considered as a substitute tool for a merger simulation. However, since it does not require much time, we may consider the index calculation as an additional instrument to a merger simulation.

The UPP method, as was discussed, has several drawbacks and is not interesting for us since it does not yield results for both brands simultaneously and anyway needs assumptions about the underlying demand system to obtain results terms of price increase.

To quantify the merger effect for both of the brands, a 2-stage simulation model would be used, first choosing an underlying demand system and then conducting a merger simulation itself, by solving the first order conditions, assuming the market is in equilibrium and that the merged firm makes pricing decisions to maximize the profit.

Considering the number of market participants, usage of AIDS will require estimation of 144 coefficients. Additionally, since the main purpose of the research is to predict the unilateral effects, we will not need the explicit study of demand patterns and the estimation of every price elasticity coefficient. Related econometric difficulties and the quantity of coefficients to estimate will require additional time investments that antitrust authorities usually do not have.

We take a closer look at the logit demand model, which requires estimation of 24 coefficients. This demand model was used in many works and produces precise results, when investigator takes into account all drawbacks and limitations of the model. We will consider these drawbacks in relation to the U.S. domestic airline industry.

One of the biggest drawbacks of the ALM is the "IIA" property. It means that the substitution of the good in case of the price increase will be proportional to the shares of the other goods. This assumption may lead to inaccurate patterns of demand like substitution of luxurious goods with cheaper ones (for example substitution of Maserati Ghibli with Toyota Camry). However, on the market of the U.S. air transportation, when we consider only economy class, the goods are quite close substitutes. Besides, the substitution will be strongly affected by the market shares, as shares themselves are shaped by networks of companies meaning that bigger companies are more likely to be the desired substitutes than the smaller ones. Additionally, the "IIA" works better when there are many companies with comparable shares, which means that in case one company raises prices, the shortfall in demand will be split over all other companies in comparable terms. Willig (1991) in his work argued that "IIA" is the appropriate and most natural default assumption for substitution patterns and when the merging firms products are neither particularly close together nor far apart in characteristics space.

The implementation of "nested" ALM could help to relax the "IIA" assumption. In the "nested" case, products are grouped in "nests" in such a way that inside nests more correlation between products is allowed. This means that in case of a price increase, the cross-price elasticities of goods inside the "nest" will be higher than for goods outside the "nest".

As was shown in studies using the ALM, the model might predict inconsistent results in case of a new entry. However, in the particular case of United States airline industry, we can maintain the assumption that a new entry is not expected in case prices have increased. Observing the history, we see that since 1995 there was no entry of an airline that would have reached comparable market shares to the major players. What is more, all entries were done in the LLC segment. The latest successful entrant is Virgin America that entered the market in 2007 and at the moment of the American-U.S. merger accounts for 1,6% of the market (market share in the first 2 years of operation equals 0,3%). Therefore, we can conclude that the new entry is quite unlikely. Even in the case of an entry in the short-term that we are considering in our research, the new entrant will most probably have a small market share (much less than 1%) so that we will not take this player into account.

Summarizing, we see that despite some drawbacks, the ALM is a suitable model for the particular studied case and offers the best value to effort in comparison to the Almost Ideal Demand System that requires more time and inputs.

4.2. Overview of works that used the ALM

Epstein and Rubinfeld (2004) discussed and compared different demand models. They conducted merger simulations with various underlying systems for 2 cases. The mergers were hypothetical and the simulations were made as exercises, the real price increase was unknown.

In the first case, they considered a beer market for 6 composite brands, two brands of which merged: Bud (6,6% quantity share; 7,1% revenue share) and Old Style (17,2% quantity share; 13,7% revenue share) merge. The AIDS predicts 3,4% increase in the price of Bud and 3% increase in the price of Old Style whereas the ALM predicts 6% price increase for Bud and 1,5% for Old Style. Both models predicted comparable substantial price increases, but the logit model yielded the highest single effect, as well as the lowest effect. The difference in results would be even lower, if we consider the share-weighted average price increase on the market.

In the second case, the toilet tissue case was considered, where the authors assumed merger between Charmin (22,5% quantity share; 21,9% revenue share) and Scott (18,9% quantity share; 25,5% revenue share). The obtained results show that AIDS predicts an increase of 8,7% for Charmin and 8% for Scott while the logit model forecasts 3% price increase for Charmin and 5,3% for Scott.

As we see, the ALM predicts higher price increases for the brand with a lower market share, which is consistent with the model assumption. However, the results are quite close to the AIDS outcome and would have been even more accurate in case of close values of market and revenue shares. Moreover, the difference in results comes from the difference in underlying market shares – quantity shares for the ALM and revenue shares for AIDS.

Davis and Wilson (2003) designed an experiment to conduct a behavioral assessment of the Antitrust Logit Model. They studied the pricing decisions for 24 differentiated product markets with 4 firms. For each market the experiment was running for 60 periods, where after period 30 a merger occurred. Then, one of the market participants was given control over the pricing decisions of another seller. After that, markets operated for additional 30 periods. Then the authors compared observed post-merger prices with the ones predicted by the model to make an assessment of the forecasting power.

The ALM appeared to detect the problematic mergers quite well, such that it detected the markets with substantial price increases. However, the authors had concerns about the drivers of the behavior. Particularly, they argue that the pre-merger deviations from the equilibrium are more powerful drivers than the exercise of market power.

Summarizing, the ALM can serve as a good device for the main purpose of the merger simulations – screening out mergers that can lead to a market price increase. Besides, the quantitative predictions are close to the more sophisticated and time consuming demand system – the Almost Ideal Demand System.

5. Estimation

5.1. Demand model

We follow the paper of Werden and Froeb (1994) to specify the demand system using a logit demand.

The ALM demand model is specified, assuming that consumers make a discrete choice from a set of n alternatives, where the ultimate choice provides the greatest utility. The choice is a quantity. The indirect utility function is:

$$U_{ij} = \propto_j + \beta p_j + e_{ij}.$$

The utility is a function of the own price p_j, fixed effect quality parameter $\propto_j$ and the coefficient β reflecting the sensitivity of consumers to a price change that is assumed to be constant for all consumers and brands, e_{ij} represents consumers' preferences for the brand.

Assuming that e_{ij} follows an extreme value distribution, the probabilities of choosing a particular brand j becomes

$$\pi_j = \frac{\exp(\propto_j + \beta p_j)}{\sum \exp(\propto_k + \beta p_k)}.$$

These probabilities describe possibilities in a full set of consumer choices. For the purposes of merger simulation, we collected data on major airlines (market share more than 1%) that together have approximately 90% of the market share ($\sum_g^{j=1} s_j \sim 90\%$, where s_j is the market share of brand j, g is the number of major airlines). They are defined as "inside" market and the remaining share is aggregated to an "outside" good with a market share of $1 - \sum_g^{j=1} s_j$. Epstein and Rubinfeld (2004) offer such approach for the case when the sum of the market shares of considered goods not equals 100%. This is done because smaller airlines (market share less then 1%) than the ones we consider for demand model estimation mostly compete on distinct paths in certain areas and can not be considered as direct competitors to airlines that operate in all parts of the country. The "inside" market quantity shares are then defined as follows:

$$s_j = \frac{\pi_j}{1 - \pi_n}, \qquad (1)$$

for j = 1, …, g, where g is the number of brands on the "inside" market, π_j is a choice probability of an "inside" good that equals the quantity market share of this good, π_n is a choice probability for an "outside" aggregated good, that equals the quantity market share of this good.

For the process of estimation, the model has to be linearized. It is done by using the transformation $\ln(\pi_j/\pi_n)$ as the dependent variable for the brand j share equation.

$$\ln\left(\frac{\pi_j}{\pi_n}\right) = \ln\left(\frac{\exp(\propto_j + \beta p_j)}{\sum \exp(\propto_k + \beta p_k)} \times \frac{\sum \exp(\propto_k + \beta p_k)}{\exp(\propto_n + \beta p_n)}\right),$$

for j, k = 1, …, g, where $\propto_n$ is a quality parameter to be estimated, p_n is the price for the "outside" good.

After the transformation, each brand share equation is of the form

$$\ln(\pi_j/\pi_n) = \propto_j - \propto_n + \beta(p_j - p_n), \text{ for } j = 1, \dots, g. \qquad (2)$$

We have g equations in total. The complete model is estimated as a system with restriction on β, since it is the same in each equation.

Elasticities in the ALM depend on two estimated parameters. The parameters are the industry elasticity ε and the logit parameter β. Elasticities are given by:

$$\eta_{jj} = \frac{(\beta\bar{p}\left(1 - s_j\right) + \varepsilon s_j)p_j}{\bar{p}} \qquad (3)$$

and

$$\eta_{jk} = \frac{s_k(-\beta\bar{p} + \varepsilon)p_k}{\bar{p}}, \qquad (4)$$

for j, k = 1, …, g, k ≠ j, where η_{jj} is the own-price elasticity, η_{jk} is the cross-price elasticity, $\bar{p}$ is share-weighted average price.

Thus, the IIA property is imposed ($\eta_{jk} = \eta_{ik}$). The own price elasticity (η_{jj}) has to be smaller than zero and reflects the change in the demand of a brand with respect to the price increase of this brand. The cross-price elasticity (η_{jk}) has to be greater than zero and reflects the change in demand with respect to the price increase of other brands. Davis and Wilson (2003), Epstein and Rubinfeld (2004) advise to take the industry elasticity parameter ε from the existing researches for the better precision of the results.

To relax the "IIA" assumption, the model is estimated with additional "nesting" parameter (σ_h). Products that are closer substitutes are formed in groups or so called "nests". More correlation between the goods is allowed inside the "nest". In the studied case, the "nests" are defined according to the type of the airline. Full-service carriers form nest 1 (σ_1) and low-cost carriers form nest 2 (σ_2).

Following the model implementation by Björnerstedt (2013), the formal equation is then given by the formula:

$$\ln(\pi_j/\pi_n) = \propto_j - \propto_N + \beta(p_j - p_n) + \sigma_h \ln(s_{j|h}), \qquad (5)$$

for j = 1, …, g, h = 1, 2.

where σ_h is a nesting parameter, and $s_{j|h}$ is a share of brand j in nest h.

Price elasticities are then given by:

$$\eta_{jj} = (1 - \pi_j + (\frac{1}{\sigma_h} - 1)(1 - s_{j|h}))\, \beta p_j \qquad (6)$$

and

$$\eta_{jk} = \begin{cases} -\left(\pi_j + \left(\frac{1}{\sigma_h} - 1\right) s_{j|h}\right) \beta p_j, \text{if j, k are both in nest h} \\ -\beta \pi_j p_j, \text{if j is not in nest h but k is.} \end{cases}, \qquad (7)$$

for j, k = 1, …, g, k ≠ j, h = 1, 2.

5.2. Merger simulation

After we have accomplished the first step and specified the demand system and estimated own and cross price elasticities, we can proceed with the second step - the merger simulation itself. We would simulate the merger effects to see whether it will lead to the price increase with efficiency gains and without them.

We closely follow the approach from the work of Hausman et al. (1994). This approach allows focusing on how the prices of merging firms' change, while holding the prices of other firms' constant. We solve the first order conditions for the merged firm and express the results in terms of prices, price elasticities and market shares. This approach could be used with any underlying demand system and provides a direct impact on the prices as a result.

Firms operate on a market with differentiated Bertrand competition under x brands. We assume that a new entry on the market is not expected.

Firm i operates under brand i and sets price to maximize the profit (Π_i):

$$\Pi_i = (p_i - mc_i)Q_i(p_1, \ldots, p_x),$$

for i = 1, …, x, where x is number of brands on the market, p_i denotes pre-merger price, mc_i denote pre-merger marginal cost and Q_i denote quantity.

Maximizing profit, the first order condition is given by:

$$\frac{\partial \Pi_i}{\partial p_i} = Q_i(p_1, \ldots, p_x) + (p_i - mc_i)\frac{\partial Q_i}{\partial p_i} = 0,$$

for i = 1, …, x.

Rearranging and keeping in mind that own price elasticity η_{ii} is:

$$\eta_{ii} = \frac{\partial Q_i}{\partial p_i}\frac{p_i}{Q_i},$$

for i = 1, …, x.

We get that in the equilibrium, the firm i sets price based on:

$$\frac{p_i - mc_i}{p_i} = -\frac{1}{\eta_{ii}}, \qquad (8)$$

for i = 1, …, x.

Now Firm 1 that operates under brand 1 merges with Firm 2 that operates under brand 2. If the merged firm raises the price of one of the brands, some of the lost demand will go to the other brand (since brands 1 and 2 are substitutes). This absence of constraints of one product over another may lead to a price increase.

The combined firm sets the post-merger prices p_1^M and p_2^M to maximize the profit (Π^M):

$$\Pi^M = (p_1^M - mc_1^M)Q_1(p_1^M, \dots, p_x^M) + (p_2^M - mc_2^M)Q_2(p_1^M, \dots, p_x^M)$$

Where mc_1^M, mc_2^M are the marginal costs after the merger.

The optimal prices are given by the first order conditions for every brand of the merging firms:

$$\frac{\partial \Pi^M}{\partial p_j^M} = s_j + \sum_{k=1}^{2} (\frac{p_k^M - mc_k^M}{p_k^M} s_k)\eta_{kj} = 0, \qquad (9)$$

for j = 1, 2 are brands that are operated by a combination of the merging firms and s_j is the market share.

Firms that are not involved in the merger are maximizing their profits as they were maximizing before the merger:

$$\frac{p_i - mc_i}{p_i} = -\frac{1}{\eta_{ii}},$$

for i = 3, …, x are brands that are not involved in the merger.

We rewrite the first order conditions (9) for brand 1 and brand 2 as a system of the following equations:

$$\begin{cases} s_1 + s_1\eta_{11}\dfrac{p_1^M - mc_1^M}{p_1^M} + s_2\eta_{21}\dfrac{p_2^M - mc_2^M}{p_2^M} = 0 \\ s_2 + s_2\eta_{22}\dfrac{p_2^M - mc_2^M}{p_2^M} + s_1\eta_{12}\dfrac{p_1^M - mc_1^M}{p_1^M} = 0 \end{cases}. \qquad (10)$$

Define $\frac{p_j - mc_j}{p_j} = \theta_j$ as a price-cost markup, $\frac{p_j^M - mc_j^M}{p_j^M} = \theta_j^M$ as a post-merger price-cost markup.

Solving the system (10) for brand 1 and 2 post-merger price-cost markups (θ_1^M and θ_2^M) gives us:

$$\frac{p_1^M - mc_1^M}{p_1^M} = \frac{s_2 \frac{\eta_{21}}{\eta_{22}} - s_1}{s_1\eta_{11} - s_1 \frac{\eta_{12}\eta_{21}}{\eta_{22}}} \qquad (11)$$

and

$$\frac{p_2^M - mc_2^M}{p_2^M} = \frac{s_1 \frac{\eta_{12}}{\eta_{11}} - s_2}{s_2\eta_{22} - s_2 \frac{\eta_{12}\eta_{21}}{\eta_{11}}}. \qquad (12)$$

By rearranging pre- and post-merger price-cost markups, we obtain

$$p_j = \frac{mc_j}{(1 - \theta_j)},$$

$$p_j^M = \frac{mc_j^M}{(1 - \theta_j^M)},$$

for j = 1, 2.

Then the relation of post-merger prices to pre-merger prices is given by:

$$\frac{p_j^M}{p_j} = \frac{\frac{mc_j^M}{mc_j}}{(\frac{p_j}{mc_j})(1 - \theta_j^M)},$$

for j = 1, 2.

The pre-merger price to marginal cost ratio in the denominator of the previous equation can also be written as the ratio of the own-elasticity of demand from (8), $(\eta_{jj}/(1+\eta_{jj}))$. The percentage price change following the merger is expressed as:

$$\frac{p_j^M - p_j}{p_j} = \frac{\frac{mc_j^M}{mc_j}}{\frac{\eta_{jj}}{1 + \eta_{jj}}(1 - \frac{p_j^M - mc_j^M}{p_j^M})} - 1, \qquad (13)$$

for j = 1, 2.

Thus, the effect of the merger depends on own and cross-price elasticities of demand for the two merging firms and the reduction in marginal costs.

If there are no changes in marginal cots, then:

$$\frac{p_j^M - p_j}{p_j} = \frac{1}{\frac{\eta_{jj}}{1+\eta_{jj}}(1 - \frac{p_j^M - mc_j^M}{p_j^M})} - 1, \qquad (14)$$

for j = 1, 2.

5.3. Data

The main data origin was the Bureau of Transportation Statistics. Customized data query was created for a domestic segment (so called T-100 segment on the website of BTS) that consisted of quarterly observations. The time period is from the last quarter of 2002 to the last quarter of 2013. In total there are 45 points in time. The length of the time series could have been increased. However, data as of 2001 and the first quarters of 2002 was heavily influenced by the attacks that occurred in 2001 involving the planes of the two major U.S. passenger air carriers. The data prior to 2001 was not fully available on domestic passenger revenue.

The data consists of domestic Revenue Passenger Miles or RPM (number of passenger multiplied by number of miles they flown) as a measure of quantity market shares and domestic average prices per RPM for the major airlines of the United States. Market shares were not measured in terms of transported passengers, since flights are different in length and therefore price. The RPM is considered as a total level of output of an airline and indicator of market shares. Price per RPM was obtained by dividing the revenue from passengers by number of passenger miles, which represents the price charged to passengers per one unit of output of an airline.

As an additional data source, the Airline Data Project of the Massachusetts Institute of Technology was used. This source offers annualized data on the key metrics of airline performance and was mainly used for collecting additional information (average flight length, size of the fleet, types of the planes in fleet) and for comparison the collected data from BTS to its figures (RPM, price per RPM) for ensuring data consistency.

6. Results

6.1. Herfindahl – Hirschman Index

As a first step of the merger analysis, the least comprehensive method was applied. The method requires only market shares of the companies within the market for just one point in time (before the merger). However, it is impossible to collect information on market shares of all airlines in the domestic segment and it is simply not available for some carriers. We have data for airlines that in sum ($\sum_{g}^{j=1} s_j$) account for approximately 90% of the market. The rest market share would be considered as a single "outside" good with a share of $1 - \sum_{g}^{j=1} s_j$. Therefore, the calculated HHI value will be an upper bound (the real HHI will be smaller or equal to this value), since we will consider the rest market share as one big airline (comparable to Delta and American airlines pre-merger in terms of market shares). This will result in a higher HHI value than if we would have considered many small airlines for this amount of market share.

From Table 4, we see that the share of an "outside" good ($1 - \sum_{g}^{j=1} s_j$) is 12,2%. American Airlines (AMA) and US Airways (USA) have shares of 12,6% and 8,5% respectively. To obtain the industry HHI value, we sum up the squares of market shares of every firm, including the "outside" share. The resulting HHI value is 1257,5. After that, we recalculate the index when AMA and USA merge.

Company	Share
AMA	12,6%
USA	8,5%
UNI	15,7%
SWT	17,8%
JBL	5,1%
FRO	1,6%
VAM	1,7%
ALA	4,0%
HAW	1,6%
SPI	2,0%
ALL	1,1%
DEL	16,0%
Outside	12,2%
Total	100%
HHI	**1257,5**

Table 4. Market shares and the HHI before the merger. Airline codes can be found in the Appendix point 1.

Table 5 represents the market shares and the HHI value after the AMA – USA merger. The resulting company, which is named AMA in the table, now accounts for 21,2% of the market share (sum of the shares of AMA and USA before the merger). The merger increased the industry HHI value to 1473,5.

Company	Share
AMA	21,2%
UNI	15,7%
SWT	17,8%
JBL	5,1%
FRO	1,6%
VAM	1,7%
ALA	4,0%
HAW	1,6%
SPI	2,0%
ALL	1,1%
DEL	16,0%
Outside	12,2%
Total	100%
HHI	**1473,5**

Table 5. Market shares and the HHI after the merger. Airline codes can be found in the Appendix point 1.

According to DOJ/FTC's 2010 Horizontal Merger Guidelines, a resulting merger might potentially raise significant competitive concerns if it increases the HHI by more than 100 points when the market is "moderately concentrated" or has a post-merger HHI score of more than 1500. In our case the post-merger HHI value equals 1473,5. Even with an upper bound calculation, the threshold is not breached and the merger would have been classified as unlikely to have adverse competitive effects.

6.2. Antitrust Logit Model

The model was estimated in R, using the equation (2) for each airline and a restriction matrix on β coefficient, such that it is the same in each equation.

The estimated value for β coefficient is -10,04. The domestic airline industry elasticity parameter (ε) was set to -0,8 according to research for IATA (International Air Transport Association). The values of β and ε were plugged into (3) to compute own-price elasticities (η_{jj}) and into (4) to obtain cross-price elasticities (η_{jk}).

The full matrix of estimated price elasticities is as follows:

	AMA	USA	UNI	SWT	JBL	FRO	VAM	ALA	HAW	SPI	ALL	DEL
AMA	-1,452	0,058	0,100	0,133	0,033	0,009	0,010	0,025	0,011	0,008	0,005	0,118
USA	0,088	-1,453	0,100	0,133	0,033	0,009	0,010	0,025	0,011	0,008	0,005	0,118
UNI	0,088	0,058	-1,312	0,133	0,033	0,009	0,010	0,025	0,011	0,008	0,005	0,118
SWT	0,088	0,058	0,100	-1,524	0,033	0,009	0,010	0,025	0,011	0,008	0,005	0,118
JBL	0,088	0,058	0,100	0,133	-1,382	0,009	0,010	0,025	0,011	0,008	0,005	0,118
FRO	0,088	0,058	0,100	0,133	0,033	-1,216	0,010	0,025	0,011	0,008	0,005	0,118
VAM	0,088	0,058	0,100	0,133	0,033	0,009	-1,335	0,025	0,011	0,008	0,005	0,118
ALA	0,088	0,058	0,100	0,133	0,033	0,009	0,010	-1,359	0,011	0,008	0,005	0,118
HAW	0,088	0,058	0,100	0,133	0,033	0,009	0,010	0,024	-1,510	0,008	0,005	0,118
SPI	0,088	0,058	0,100	0,133	0,033	0,009	0,010	0,024	0,011	-0,828	0,005	0,118
ALL	0,088	0,058	0,100	0,133	0,033	0,009	0,010	0,024	0,011	0,008	-1,061	0,118
DEL	0,088	0,058	0,100	0,133	0,033	0,009	0,010	0,024	0,011	0,008	0,005	-1,510

Table 6. Estimated own and cross-price elasticities for logit demand. Airline codes can be found in Appendix point 1.

From table 6, we see that the "IIA" property is imposed, since $\eta_{ij} = \eta_{kj}$. The results are consistent with the theory, since coefficients on the diagonal have a negative sign, reflecting the own-price elasticities. Other coefficients have a positive sign, being cross-price elasticities. What is more, the values of the coefficients suggest that companies with bigger market shares have bigger cross-price elasticities. For example, the highest value of 0,133 belong to SWT with 17,8% market share, followed by DEL with 0,118; 16% market share and UNI with 0,1 and 15,7% market share.

The only concerns about the coefficients might be in the case when parameters indicate that users of the full-service carriers switch to a low-cost carrier extensively. As was mentioned in chapter 3.1, the difference between domestic economy class of FSC and LCC is not that essential, however this should be mentioned. Since the majority of companies in the LCC segment are small (market shares are 1%; 2%; 1,6%; 1,5%; 5%), they have relatively small cross-price elasticity coefficients (0,03; 0,009; 0,01; 0,008; 0,005) that mean they will not attract customers too much after any of other companies increases prices. Only one company from the budget segment significantly attracts customers to itself in case of a price increase - Southwest Airlines, because of a huge market share.

Computed price elasticities are then plugged in equations (11) and (12) to calculate the price-cost markups. After that, the price-cost markups and elasticities are used in equation (14) to calculate the percentage price increase per revenue passenger mile for the merging firms in case there are no efficiency gains.

The predicted price increase by the model in the table below represents, that the price increase is 15,81% for US Airways (USA) and 10,59% for American Airlines (AMA). We see that the predicted price increase is higher for USA since it has a lower market share. Such result is consistent with the findings of Epstein and Rubinfeld (2004).

Company	Price increase
AMA	10,59%
USA	15,81%

The model predicts that there will be a substantial price increase that will harm customers and such a merger should be investigated more precisely or even blocked. However, it should be noted that the merged companies claimed there would be efficiency gains from the merger. Example of reduction in marginal costs could be purchase of new more fuel-efficient planes. Moss (2013) studied claimed efficiencies with actual and concluded that usually mergers lead to minor costs reductions.

By assuming marginal cost reductions at the level of 5%, we plug in the ratio of post-merger marginal costs to pre-merger marginal costs of 0,95 into the equation (13) keeping else as in equation (14) to obtain the predictions of the price increase per revenue passenger mile that could be found in the table below. The price increase for AMA equals 5,06% and the price increase for USA equals 10,02%.

Company	Price increase
AMA	5,06%
USA	10,02%

As we see, the difference between predictions of price increase for two merging companies is still quite significant.

6.3. Antitrust Nested Logit Model

We will calibrate the logit model with “nests” (5), using the estimated results of the normal logit model. First of all, companies were distributed between two nests, based on their type. Full-service carriers (FSC) were assigned to nest 1; low-cost carriers were assigned to nest 2. The classification of companies was based on the document from ICAO (International Civil Aviation Organization) website. The separation of goods by "nests" and the shares inside them are represented in table 7 below. DEL has the highest market share in nest 1 (27,4%), followed by UNI (26,8%) and AMA (21,6%). SWT has the highest market share in nest 2 (60,8%), followed by JBL (17,5%).

Company	Share	Share in the nest	Nest
AMA	12,6%	21,6%	1
USA	8,5%	14,6%	1
UNI	15,7%	26,8%	1
SWT	17,8%	60,8%	2
JBL	5,1%	17,5%	2
FRO	1,6%	5,3%	2
VAM	1,7%	5,6%	2
ALA	4,0%	6,9%	1
HAW	1,6%	2,7%	1
SPI	2,0%	6,9%	2
ALL	1,1%	3,9%	2
DEL	16,0%	27,4%	1

Table 7. Market shares, nested shares and nests. Airline codes can be found in the Appendix point 1.

The model (5) was calibrated as follows. We calibrate the values of β and σ_h in a way to obtain higher values of cross-price elasticities (7) between goods in the same nest, than in the case of the normal logit (table 6). Own-price elasticities' (6) values are calibtated as close as possible to the corresponding values in the normal logit case (table 6). The calibrated β parameter is -9,8. The calibrated nesting parameters σ_h are 0,974 for nest 1 and 0,952 for nest 2. The domestic airline industry elasticity parameter (ε) was set to -0,8 according to research for IATA (International Air Transport Association). The elasticity parameter ε and calibrated values of β, σ_h were plugged in equations (6) and (7) to obtain the set of own and cross-price elasticities (η_{jj} and η_{jk}) respectively. The full matrix of own and cross-price elasticities is represented in the table 8.

	AMA	USA	UNI	SWT	JBL	FRO	VAM	ALA	HAW	SPI	ALL	DEL
AMA	-1,452	0,060	0,103	0,125	0,031	0,008	0,009	0,026	0,011	0,007	0,005	0,122
USA	0,091	-1,453	0,103	0,125	0,031	0,008	0,009	0,026	0,011	0,007	0,005	0,122
UNI	0,091	0,060	-1,311	0,125	0,031	0,008	0,009	0,026	0,011	0,007	0,005	0,122
SWT	0,082	0,055	0,094	-1,524	0,043	0,011	0,013	0,024	0,010	0,010	0,007	0,110
JBL	0,082	0,055	0,094	0,174	-1,407	0,011	0,013	0,024	0,010	0,010	0,007	0,110
FRO	0,082	0,055	0,094	0,174	0,043	-1,245	0,013	0,024	0,010	0,010	0,007	0,110
VAM	0,082	0,055	0,094	0,174	0,043	0,011	-1,365	0,024	0,010	0,010	0,007	0,110
ALA	0,091	0,060	0,103	0,125	0,031	0,008	0,009	-1,361	0,011	0,007	0,005	0,122
HAW	0,091	0,060	0,103	0,125	0,031	0,008	0,009	0,026	-1,513	0,007	0,005	0,122
SPI	0,082	0,055	0,094	0,174	0,043	0,011	0,013	0,024	0,010	-0,847	0,007	0,110
ALL	0,082	0,055	0,094	0,174	0,043	0,011	0,013	0,024	0,010	0,010	-1,086	0,110
DEL	0,091	0,060	0,103	0,125	0,031	0,008	0,009	0,026	0,011	0,007	0,005	-1,508

Table 8. Estimated own and cross-price elasticities for nested logit demand. Airline codes can be found in Appendix point 1.

We see from table 8, that companies in the same nest have higher cross-price elasticities than in the different nests. For example, AMA has higher cross-price elasticity value for USA, UNI, DEL (0,091) and lower cross-price elasticity value for SWT, JBL, FRO (0,082) in comparison to the same value for all companies in the normal logit case (0,088). Introduction of "nests" has slightly decreased the cross-price elasticity value for SWT to 0,125 for the nest 1 and increased to 0,174 for the nest 2 from 0,133 in the normal logit case. Such findings suggest that the "IIA" property was slightly relaxed. Since the cross-price elasticities of AMA and USA have increased, we expect that the magnitude of the price increase should be also increased.

As in the case of logit demand, computed price elasticities are then plugged in equations (11) and (12) to calculate the price-cost markups. After that, the price-cost markups and elasticities are used in equation (14) to calculate the percentage price increase per revenue passenger mile in case there are no efficiency gains.

The predicted price increase is represented in the table below. We see that the price increase for USA (16,51%) is higher than price increase for AMA (11,07%).

Company	Price increase
AMA	11,07%
USA	16,51%

The nested logit model predicts higher prices than the normal logit does. This is explained by higher cross-price elasticity values between the merging brands.

If we assume 5% efficiency gains, as we assumed in the normal logit case, we plug in the ratio of post-merger marginal costs to pre-merger marginal costs of 0,95 into the equation (13) keeping else as in equation (14) to obtain the predictions of the price increase per revenue passenger mile that could be found in the table below. The price increase for AMA equals 5,52% and the price increase for USA equals 10,69%.

Company	Price increase
AMA	5,52%
USA	10,69%

6.4. Comparison of results

The Herfindahl-Hirschman index does not classify the studied merger as problematic. Despite still being used by antitrust authorities due to the simplicity, such approach does not appear to be a good screening device.

The merger simulation with logit demand and a modified version with "nests" both forecast a substantial price increase after the merger of American Airlines and US Airways.

The results were compared to the actual figures in a relatively short-term perspective – year 2014, when companies have merged, but still operated under original brand names. We did not compare predicted results to figures of 2015 because of 2 reasons: firstly, as was mentioned, the model was designed for predictions in a short-term, such that the estimated coefficients remain the same and no new entry occurs; secondly, in 2015 companies already operated under AMA brand name only.

The ALM with and without nest yields close results to each other, despite the matrix of elasticities represents considerable difference between the models. In the case when demand with "nests" was assumed, the estimated price increase for the merging firms was higher than in the case when normal demand was used because of the higher cross-price elasticities between the merging brands. The predicted increase for AMA is 5,06% for the normal logit and 5,52% for the nested logit. The predicted price increase for USA is 10,02% for the normal logit and 10,69% for the nested logit. The price increase represents an increase in average price per revenue passenger mile for each company.

If we look at the actual prices (table 9), we see that there was a substantial price increase for the merging firms in reality (4,88% increase for AMA and 5,6% for USA). As we see, there was also a price increase from 2012 to 2013 (2,34% for AMA and 1,49% for USA). This could be partially explained by the inflation level, which was 1,5% in 2013. In comparison with the changes from 2013 to 2014, the price increase is more than 3 times bigger for USA and more than 2 times bigger for AMA than was from 2012 to 2013. Such figures suggest that the price increase was mainly because of the merger. Notably, the inflation in 2014 was 0,76% (2 times lower than in 2013).

Company	**Price increase**	
	2012/2013	2013/2014
AMA	2,34%	4,88%
USA	1,49%	5,60%

Table 9. Real observed price increase.

The estimated price increase for the AMA is very close to the real (difference between real prices and predicted is 0,18% for the normal logit and 0,64% for the nested logit) and is forecasted more precisely by the normal logit model. The actual price increase for USA was bigger than for AMA, as was forecasted by the models. However, both models overestimated the size of the difference for USA (difference between real prices and predicted is 4,42% for normal logit model and 5,09% for nested logit model).

Described results are represented in Table 10.

Company	Price increase		
	Normal logit	Nested logit	Actual
AMA	5,06%	5,52%	4,88%
USA	10,02%	10,69%	5,60%

Table 10. Comparison of results between the models.

7. Conclusion

We have conducted a merger analysis in the airline industry, aggregating demand to the level of the whole domestic air industry.

The used approach offers a relatively simple tool set to screen out problematic mergers and quantify the impact on prices within tight time frames that antitrust economists usually have. This helps to immediately detect a merger that might raise significant competitive concerns and lead to a price increase. Such procedure could be done in the very beginning of an investigation. After that an economist could take the decision whether continue the investigation or not. Instead of starting the analysis on a route level that will be time-consuming and represent effects partially, it appears to be more effective to first understand the net impact of the deal.

Data from Bureau of Transportation Statistics website on domestic RPM and price per RPM was collected. We followed the logit demand model

(Werden and Froeb (1994)) and it's "nested" modification to estimate own and cross-price elasticities. After that, we followed Hausman et al. (1994) to predict the quantitative effects of a merger.

We have found that the used approach predicted a substantial price increase as it was in reality and that the magnitude of the price increase was very close to real for American Airlines, but overestimated for US Airways. When the HHI index method that is currently often used as a screening device was applied for the same data, it classified the merger as unlikely to have adverse effects. The nested logit demand and the normal logit demand forecasted close figures to each other.

It should be mentioned, that such data aggregation approach might not always yield precise results. Basically, every route is a separate market, where market participants compete independently from other markets (e.g. New York – Los Angeles route and Las Vegas – San Francisco route are separate markets). Therefore, the market power and competition would be different for one company on different routes where it operates.

Let's consider two companies that operate on several routes (or markets) only. They probably have a low number of RPM on the domestic level. At the same time they are the only ones operating on these routes. After the merger, these markets will turn into monopoly markets, allowing increasing the prices greatly. If an investigator will conduct the analysis on the aggregate level, he will probably not notice a merger that leads to a substantial price increase. We assume that since the industry is deregulated, such markets will attract other companies and that the companies' market shares will in the end not differ too much on all of the routes together and on each of the of considered routes separately. However, this assumption could not hold in reality.

Another important point is connected with the assumption concerning the logit demand. As we have seen, it estimates the size of the price increase accordingly to the market shares of the companies. It means, that if the merging companies have significant difference in market shares, the effect will be heavily overestimated for one of the companies (with lower market share).

All in all, the studied approach might be used in merger investigations as a screening device that quantifies the price increase for the merging companies. However, all the assumptions that should be carefully considered to ensure precise results indicate applicability to a limited number of cases only.

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9. Appendix

9.1. Abbreviations of airline names used

LCC stands for low-cost carrier, FSC stands for full-service carrier (based on ICAO definition http://www.icao.int/sustainability/Documents/LCC-List.pdf)

American Airlines = AMA (FSC)

U.S. Airways = USA (FSC)

Delta Air Lines = DEL (FSC)

United Airlines = UNI (FSC)

Alaska Airlines = ALA (FSC)

Hawaiian Airlines = HAW (FSC)

Southwest Airlines = SWT (LCC)

Allegiant Air = ALL (LCC)

JetBlue Airways = JBL (LCC)

Frontier Airlines = FRO (LCC)

Virgin America = VAM (LCC)

Spirit Airlines = SPI (LCC)

9.2. Estimated coefficients of the model

The goodness of fit of the whole system was measured by the McElroy's R^2 value, which equals 0,962374.

The estimated β coefficient is -10,04 with a standard error of 0,46 (t-value of -21,81). All coefficients in the model are statistically significant at 0,001 level, except the intercept ($\propto_j - \propto_N$) for United, which is statistically significant at 0,002 level.

The estimated coefficients are represented in the table below.

Value	$\propto_j - \propto_N$	Std. Error	t-value / Pr(>|t|)	Beta (β)	Std. Error	t-value / Pr(>t)
American	0,4467755	0,0635232	7,03326 / 4,7922e-12	-10,0422702	0,4604913	-21,80773 / <2,22e-16
US Airways	-0,2685981	0,0641399	-4,18769 / 3,1763e-05	-10,0422702	0,4604913	-21,80773 / <2,22e-16
United	0,199639	0,0629426	3,17177 / 0,001581	-10,0422702	0,4604913	-21,80773 / <2,22e-18
Southwest	0,3452342	0,0637734	5,41345 / 8,4908e-08	-10,0422702	0,4604913	-21,80773 / <2,22e-21
JetBlue	-1,0968683	0,0621262	-17,6555 / <2,22e-16	-10,0422702	0,4604913	-21,80773 / <2,22e-22
Frontier	-2,0287925	0,0625939	-32,4120 / <2,22e-16	-10,0422702	0,4604913	-21,80773 / <2,22e-24
Virgin America	-1,757437	0,06469	-27,1671 / <2,22e-16	-10,0422702	0,4604913	-21,80773 / <2,22e-25
Alaska	-1,0820548	0,0641004	-16,8806 / <2,22e-16	-10,0422702	0,4604913	-21,80773 / <2,22e-26
Hawaiian	-2,0263481	0,0631518	-32,0870 / <2,22e-16	-10,0422702	0,4604913	-21,80773 / <2,22e-27
Spirit	-2,591736	0,0620999	-41,7350 / <2,22e-16	-10,0422702	0,4604913	-21,80773 / <2,22e-28
Allegiant	-3,0228584	0,0626132	-48,2783 / <2,22e-16	-10,0422702	0,4604913	-21,80773 / <2,22e-29
Delta	0,3669659	0,0635323	5,77606 / 1,1484e-08	-10,0422702	0,4604913	-21,80773 / <2,22e-30