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Merger Simulations in the American Airline Industry

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1 Introduction

The U.S. airline industry has a long history of mergers, that starts from the late 1950s. The concentration of the industry has steadily grown and is still going on. Since 2010, different major mergers were cleared by the American authorities: Northwest Airlines - Delta Airlines, Continental Airlines - United Airlines, American Airlines - US Airways, and so on. There is no obvious reason why this concentration phenomenon will stop today, so it seems reasonable to expect more mergers within the industry in the near future. Merger simulations are an increasingly popular exercise that allows Competition authorities to assess the economic impact of mergers. They were popularized by papers such as Ivaldi & Verboven (2005), from which this paper is inspired. They remain, by definition, a guess on those impacts. However, a well defined simulation can provide much more insights than a "simple" analysis of market shares. Peters (2006) actually performs merger simulations in the airline industry, using data from the 1980s. He claims that the performance of the merger simulations is not that good due to a lack of flexibility. In this paper, the author performs the simulation at the national level, the marginal costs are recovered, and Bertrand conduct is assumed. Here, simulations will be performed at the market level, marginal costs will be directly estimated, and simulations will be based on a general quantity game. Moreover, the most recent data will be used. The great availability of airline data in the U.S.A. from the Bureau of Transportation Statistics appears as an opportunity to simulate mergers in this market. These data have been used repeatedly in various competition topics, because of their availability and of the evolution of the industry, that went from strictly regulated to almost totally liberalized. One example is Borenstein (1992). In this paper, the author predicted that the number of airlines should be greatly reduced to just a few after the large deregulation of the industry during the late 70s. This is very well observed today. Borenstein also mentions how competition seems unsustainable in network industries, thus leading to fewer and fewer firms. In a previous paper, Borenstein (1990) however demonstrated that some mergers gave increased market power to some airlines. This was later supported in Kim & Singal (1993), in which the authors demonstrated that mergers can indeed allow airlines to be more efficient but still overall lead to increased market power. This paper will simulate mergers to investigate, ex ante, whether or not they automatically raise prices and reduce volumes, to see if mergers today are still desirable and if so, under which conditions. The results of this paper suggest that the outcome of mergers will strongly depend on which airlines are merging, such that additional concentration might still be beneficial, as long as it is regulated.

Each airline will be considered as a single-product firm, with its own cost function, and only direct, domestic flights will be considered. Strong assumptions will have to be made. This is a necessary evil, because there remains uncertainty regarding the reality of demand and costs' structure, as well as of firm behaviour, in a given industry and/or market. Careful choices and explicit statements of those assumptions nevertheless allow to assess the credibility of the simulation. One should not forget that it remains a modelling exercise that will not perfectly fit the reality, yet can provide important insights. Some aspects will thus not be considered in great details, such as the coordinated effects of the mergers, or the entry (or exit) of new airlines.

It seems appropriate, before going further, to define what is a market in this industry. Airline companies exploit different markets that correspond to different routes. Hence, a flight from Chicago O'Hare airport to New York City John F. Kennedy airport and a flight from New York City LaGuardia airport to Chicago Midway airport will be considered to belong to the same market: the "Chicago - New York City" market (or "New York City - Chicago" market). This definition is found in numerous papers, such as Evans & Kessides (1993).

A summary of the commonly accepted best practices should then be made. First of all, one should check that the model's predictions are coherent. This will be assessed throughout the exercise. Moreover, the chosen model should be rational with the way the considered industry works. In the short term, airlines compete in prices, but in the long term they can also adjust their capacities, which is extremely costly in the short term. Therefore, airlines engage in the following game. In the first stage, they set their capacities (basically choosing how much planes to rent or buy and on which routes, and signing contracts for fuel and labour supply). The outcome of this stage is public. Then, in the second stage, airlines face the demand and compete in prices, with virtually infinite costs when producing above their capacities. Every airlines know that all competitors must commit to their first stage decision in the short run. This corresponds to the Edgeworth solution to the Bertrand paradox stating that price competition must lead to the competitive outcome in oligopoly. This commitment on capacity allows airlines to gain some market power. This is due to the rationing of supply: for instance, if a passenger is looking for the cheapest airline's flights on a specific day and they are full, she must turn to a more expensive airline that now holds her captive. This is exactly what Kreps & Scheinkman (1983) modelled. Their conclusion was really interesting: in a capacity-then-price game, with linear demand, constant marginal costs and efficient rationing, the outcome is exactly Cournot's. Doing so allows airlines to soften the competition and escape the Bertrand paradox. To support this, Brander & Zhang (1990) showed that data on airlines conduct fits Cournot much better than Bertrand or cartel models. For this reason, the simulation model will

be derived from a quantity game, even though airlines compete in prices in the short term. This is supported in Belleflamme & Peitz (2009).
An additional point to make is product differentiation. Indeed, not all airlines propose the same flight experience: the service standards differ from one airline to another: services such as Wi-Fi, meals, luggages, entertainment, etc., might be extras or included services, and their quality can significantly differ. Gayle (2004) demonstrates that passengers' choices regarding airlines depend, if not more, at least significantly on non-price characteristics. This can be seen with the many partnerships created between airlines and, for instance, food, coffee, or telecommunication firms. Flight attendants might be more trained within some airlines than within others. Some airlines offer flights at more convenient departure times, or to better located and/or equipped airports or terminals (that are more expensive for airlines) for the same destination. Some fly more spacious or luxury planes than others, equipped with more or less comfortable seats. Finally, most airlines propose mileage fidelity bonuses, which can greatly motivate a passenger to stick to her usual airline. This product differentiation is well seen through the various brand strategies adopted by airlines. It allows airlines to keep a certain degree of market power in a market that would otherwise be extremely competitive (it is already very competitive, but airlines manage to exploit elasticities as will be showed later). Each airline thus faces its own demand function. Finally, firms will be assumed, as usual, to maximize their profits. The model used will thus be a general quantity game.
Another consideration has to be made regarding the dynamics of the model. When two airlines merge, we will not expect them to launch a new product that would change the structure of the market: the airlines will keep on selling their respective products. The difference will be that joint profits will be maximized instead, and that it will be possible to redirect passengers from one merging airline to the other if profitable by, for instance, increasing the price of the cheapest of the two to redirect passengers to the most expensive airline. At most the merger will generate efficiencies and cost reductions, which will be considered. It is possible, however, that a new airline enters the market in the long term. For those reasons, a static model seems fine to suit the industry, but predictions should be considered in the short-to-medium term, because of the possible entry. The approach will thus remain simple.
The rest of the paper is organised as follows. Section 1 reviews the estimation of different parameters that are necessary to perform the simulations. A total cost function will be econometricaly estimated at the national level, with time and firm fixed effects. A marginal cost function will be derived from this total cost function, allowing for marginal costs estimations for each firm at each time period. Then, using already estimated elasticities, demand function parameters on each markets will be recovered. In Section 2, the merger simulations are performed for different markets, each time for

a variety of merger scenarios, using the parameters estimated in Section 1. In both sections, the models and results will be presented. Finally, Section 3 concludes.

2 Estimation

In this section, the key parameters used in the simulation model are estimated. Section 2.1 econometricaly estimates cost function parameters. Section 2.2 recovers demand function parameters from previous works.

2.1 Cost Function

2.1.1 Data and Variables

All data come from the Bureau of Transportation Statistics, an agency within the United States Department of Transportation. Its databases are well known and trusted. In particular the following databases were used:

- Air Carrier Financial: Schedule P-6. For quarterly data on the wage bills (in thousands of dollars) of airlines, with observations for each airline in its different geographical operating regions. Approximately 500 observations per quarter's dataset.

- Air Carrier Financial: Schedule P-10. For yearly data on the number of employees, with observations for each airline in its different geographical operating regions. Approximately 120 observations per year's dataset.

- Air Carrier Financial: Schedule P-5.2. For quarterly data on total costs (in thousands of dollars), with observations for each airline in its different geographical operating regions and each aircraft type. Approximately 1700 observations per quarter's dataset.

- Air Carrier Financial: Schedule 12(a). For monthly data on fuel total expenditure and consumptions, with observations for each airline. Approximately 750 observations per month's dataset.

- Air Carriers: T100 Domestic Segment (US Carriers). For monthly data on passengers, available seats, number of departures, distance flown and distance between airports (both in miles), with observations for each airline in its different routes (at the airport level). Approximately 330000 observations per month's database.

- Origin and Destination Survey: DB1B Market. For quarterly data on market fares. This is a 10% sample of all domestic tickets sold in the U.S.A. Millions of observations per month's dataset.

An important work of aggregation was required. i will denote an airline, y a year, q a quarter, m a month, r a route, g a geographical region, a an aircraft. Data on wage bills ($WB_{i,y,q} = \sum_g WB_{i,y,q,g}$) were summed across geographical operating regions of an airlines. Data on the number of employees was assumed stable over a given year, such that the same yearly observations was used for each quarter of that year, in order to obtain quarterly data ($L_{i,y,q} = L_{i,y}$). Data on total costs ($TC_{i,y,q} = \sum_g \sum_a TC_{i,y,q,g,a}$) were summed across geographical operating regions and aircraft types of an airlines. Data on total fuel expenditure ($TFE_{i,y,q} = \sum_m TFC_{i,y,q,m}, \forall m \in q$) and total fuel consumption ($TFC_{i,y,q} = \sum_m TFC_{i,y,q,m}, \forall m \in q$) were summed across months of a quarter. Data on passengers ($Q_{i,y,q} = \sum_r \sum_m Q_{i,y,q,r,m}, \forall m \in q$), available seats ($AS_{i,y,q} = \sum_r \sum_m AS_{i,y,q,r,m}, \forall m \in q$), number of departures ($ND_{i,y,q} = \sum_r \sum_m ND_{i,y,q,r,m}, \forall m \in q$) miles flown ($M_{i,y,q} = \sum_r \sum_m M_{i,y,q,r,m}, \forall m \in q$) and miles between airports ($\overline{M}_{i,y,q} = \sum_r \sum_m \overline{M}_{i,y,q,r,m}, \forall m \in q$) were summed across months of a quarter and across routes.
Every observations where no passengers were transported (cargo) or no departures were made are discarded.

Different variables were then created (in what follows the (i, y, q) index is dropped for convenience):

- $W = \frac{WB}{L}$, for labour price;
- $F = \frac{TFE}{TFC}$ for fuel price;
- $RPM = Q \times M$, for Revenue Passengers Miles;
- $ASM = AS \times M$, for Available Seats Miles
- $ASL = \frac{M}{ND}$, for Average Stage Length;
- $LF = \frac{RPM}{ASM}$, for Load Factor;
- TC, for Total Costs (used as such).

Summary statistics of these variables, for the years 2008 to 2016, are provided in Table 1.

Table 1: Summary Statistics

Statistic	Mean	St. Dev.	Min	Max
Total Costs (C)	676,855,985	1,082,397,423	3,121,650	5,875,292,000
Passengers (Q)	5,685,753	7,963,273	17	39,895,892
Labour Price (p_L)	15,9712	18,444	12	348,984
Fuel Price (p_F)	2.715	2.445	0.341	61.902
ASL	853	383	176	2,000
LF	0.734	0.162	0.013	1

For Total Costs, Passengers and Labour Price, the standard deviation being greater than the mean suggests a skew towards high values, so the Min of theses variables does not give much information (it could have been that there are outliers but a Residuals-Leverage plot for the regression of the cost function, which can be found in the Appendix, suggests this is not the case).

2.1.2 Model

As explained in Davis & Garcés (2006), a Cobb-Douglas production function defined as

$$Q = \alpha_0 L^{\alpha_L} F^{\alpha_F} u \tag{1}$$

yields the following cost function from cost minimization:

$$C = kQ^{1/r} p_L^{\alpha_L/r} p_F^{\alpha_F/r} v \tag{2}$$

where $v = u^{-1/r}$, $r = \alpha_L + \alpha_F$ and $k = r(\alpha_0 \alpha_L^{\alpha_L} \alpha_F^{\alpha_F})^{-1/r}$.
Taking the natural logarithm of equation (2) provides an expression suitable for linear regression, in the form

$$\ln(C) = \beta_0 + \beta_Q \ln(Q) + \beta_L \ln(p_L) + \beta_F \ln(p_F) + v \tag{3}$$

Moreover, it is common to consider Average Stage Length and Load Factor as potential determinants of airline costs. These can be found, for instance, in Ng & Seabright (2001). We will thus integrate them in the estimation. Finally, dummy variables for airlines, years and quarters are created and added to allow for changes in the intercept. It gives the following:

$$\begin{aligned} \ln(C) = {} & \beta_0 + \beta_Q \ln(Q) + \beta_L \ln(p_L) + \beta_F \ln(p_F) + \beta_{ASL} \ln(ASL) \\ & + \beta_{LF} \ln(LF) + \delta_1 \times FIRM + \delta_2 \times YEAR + \delta_3 \times QUARTER + v \end{aligned} \tag{4}$$

Finally, we impose $\beta_L + \beta_F = 1$ to satisfy the homogeneity of the cost function in input prices. The actual regression is thus:

$$\begin{aligned} \ln(C) - \ln(p_F) = {} & \beta_0 + \beta_Q \ln(Q) + \beta_L \big(\ln(p_L) - \ln(p_F)\big) + \beta_{ASL} \ln(ASL) \\ & + \beta_{LF} \ln(LF) + \delta_1 \times FIRM + \delta_2 \times YEAR + \delta_3 \times QUARTER + v \end{aligned} \tag{5}$$

This specification of the regression gives the cost function as :

$$C(Q) = \alpha Q^{\beta_Q} p_L^{\beta_L} p_F^{\beta_F} ASL^{\beta_{ASL}} LF^{\beta_{LF}} \tag{6}$$

where $\alpha = \exp(\beta_0 + \delta_1 \times FIRM + \delta_2 \times YEAR + \delta_3 \times QUARTER)$, and the marginal cost function as:

$$MC(Q) = \frac{\partial C(Q)}{\partial Q} \tag{7}$$

$$= \alpha \beta_Q Q^{\beta_Q - 1} p_L^{\beta_L} p_F^{\beta_F} ASL^{\beta_{ASL}} LF^{\beta_{LF}} \tag{8}$$

It is also interesting to note that the average cost function is:

$$AC(Q) = \alpha Q^{\beta_Q - 1} p_L^{\beta_L} p_F^{\beta_F} ASL^{\beta_{ASL}} LF^{\beta_{LF}} \tag{9}$$

2.1.3 Results

Equation (5) parameters are estimated using standard OLS, with data ranging from 2008 to 2016. Estimation results are shown in Table 2.
They appear quite robust. In columns (1) and (2), year and quarter dummies are dropped consecutively, and in column (3) the insignificant variable Average Stage Length is dropped. This does not change the significance of the parameters, and their values only slightly vary. In addition to being insignificant, the ASL parameter is estimated very close to zero. The parameter for p_F is recovered as $\beta_F = 1 - \beta_L = 1 - 0.481 = 0.519$. Using these estimates in equation (8) gives estimated marginal costs. As an example, a subset of estimated marginal costs can be found in Table 3 for top US airlines in the fourth quarter of 2016 on the Chicago - New York City route. These estimations appear coherent with the airline type, as they are significantly smaller for low-cost airlines.

2.2 Demand Function

Kim (2006) estimates airlines' conditional (that is, "conditional on the expenditure for air trip") own and cross price elasticities, ε_{kj}, at the market level, according to the number of airlines present in this market, using the Almost Ideal Demand System (AIDS) specification. These elasticities will be used in the simulation model. In the merger simulation model that will be used, a system of linear demand functions is used, as:

$$q_k = D_k(\underline{p}) = a_k + \sum_{j=1}^{J} b_{kj} p_j, \text{ for } k = 1, \ldots, J \tag{10}$$

The demand constants a_k and parameters b_{kj} are required and not provided in the previous paper, so they will have to be approximated.
Using the formula for price elasticities, at the firm level, we have that:

$$\varepsilon_{kj} = \frac{\partial D_k(\underline{p})}{\partial p_j} \frac{p_j}{D_k(\underline{p})} \tag{11}$$

Moreover, from equation (10) we have that:

$$\frac{\partial D_k(\underline{p})}{\partial p_j} = b_{kj} \tag{12}$$

So we recover the b_{kj} parameters as:

$$b_{kj} = \varepsilon_{kj} \frac{D_k(\underline{p})}{p_j} \tag{13}$$

The demand constants a_k are then recovered as:

$$a_k = D_k(\underline{p}) - \sum_{j=1}^{J} b_{kj} p_j \tag{14}$$

Table 2: Ordinary Least Squares Estimation

	Dependent variable:			
	$\ln(C) - \ln(p_F)$			
	(1)	(2)	(3)	(4)
β_0	5.860***	9.035***	8.772***	9.072***
	(0.855)	(0.883)	(0.499)	(0.884)
$\ln(Q)$	0.576***	0.480***	0.482***	0.481***
	(0.032)	(0.032)	(0.032)	(0.032)
$\ln(P_L) - \ln(P_F)$	0.357***	0.248***	0.248***	0.248***
	(0.018)	(0.021)	(0.021)	(0.021)
$\ln(ASL)$	0.058	−0.037	——	−0.047
	(0.118)	(0.114)		(0.114)
$\ln(LF)$	−0.763***	−0.668***	−0.666***	−0.661***
	(0.063)	(0.059)	(0.058)	(0.059)
Year Dummies	No	Yes	Yes	Yes
Quarter Dummies	Yes	No	Yes	Yes
Firm Dummies	Yes	Yes	Yes	Yes
Observations	957	957	957	957
R^2	0.971	0.975	0.976	0.976
Adjusted R^2	0.970	0.974	0.974	0.974
Residual Std. Error	0.276 (df = 907)	0.256 (df = 902)	0.256 (df = 900)	0.256 (df = 899)
F Statistic	628.751*** (df = 49; 907)	662.896*** (df = 54; 902)	640.756*** (df = 56; 900)	628.936*** (df = 57; 899)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 3: Marginal Costs (2016 Q4, Chicago - New York City route)

Airline	Type	Estimated Marginal Cost ($)
American Airlines	Standard	62.26
Delta Air Lines	Standard	62.63
Southwest Airlines	Low Cost	29.94
United Airlines	Standard	88.24
JetBlue Airways	Low Cost	44.15
Spirit Airlines	Low Cost	26.83

3 Merger Simulation

So far three important parameters were obtained: marginal costs, demand constants and demand parameters. They will be used within the following merger simulation model.

3.1 Model

The model used for the merger simulations can be found in Davis & Garcés (2006). We will not go into the details of the derivation of the merger model, as this is already well explained in the book previously cited. We will, however, recall its main components.
The following expression is provided for quantity games:

$$\begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} I & \Delta \cdot (B')^{-1} \\ -B' & I \end{pmatrix}^{-1} \begin{pmatrix} c \\ a \end{pmatrix} \tag{15}$$

p is the resulting price vector, of length J the number of products in the market. In our case, we will consider that a flight with an operating carrier represents one product. For instance, a seat in an American Airlines flight and a seat in an Envoy Air will be considered two different products, even if Envoy Air and American Airlines are owned by American Airlines Group. q is the quantity vector, of length J as well. $\Delta \cdot B$ is the Hadamard product of Δ and B. Δ is the symmetric ownership matrix representing the ownership structure in the market. For instance, in a market with airline brands 1 (e.g. American Airlines), 2 (e.g. United Airlines), 3 (e.g. Envoy Air) and 4 (e.g Southwest Airlines), we will have:

$$\Delta = \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \tag{16}$$

That is, $\Delta_{3,1} = \Delta_{1,3} = 1$ because American Airlines and Envoy Air are both owned by American Airlines Group. B' is a $(J \times J)$ matrix of demand

Table 4: Busiest domestic routes, Sep. 2014 - Aug. 2015

Route	Passengers
Chicago - New York City	4,020,000
Los Angeles - San Francisco	3,660,000
Los Angeles - New York City	3,420,000
Chicago - Los Angeles	3,010,000
Miami - New York City	2,750,000

parameters, such that:

$$B' = \begin{pmatrix} b_{11} & \dots & b_{1j} & \dots & b_{1J} \\ \vdots & & \vdots & & \vdots \\ b_{k1} & \dots & b_{kj} & \dots & b_{kJ} \\ \vdots & & \vdots & & \vdots \\ b_{J1} & \dots & b_{Jj} & \dots & b_{JJ} \end{pmatrix} \tag{17}$$

I is a $(J \times J)$ identity matrix. c is a vector of marginal costs and a a vector of demand constants. B', c and a thus come from what was obtained in Section 2. Equation (15) comes from a system of $2J$ equations that solve J quantity setting equations (Equation (18)) simultaneously with J demand equations (Equation (19)), respectively:

$$(\Delta \cdot (B')^{-1})q + p - c = 0 \tag{18}$$

$$q = a + B'p \tag{19}$$

The J quantity setting equations simply are the matrix form of the first-order conditions of a profit maximizing firm:

$$\sum_{j=1}^{J} \Delta_{kj} \frac{\partial P_j(q)}{\partial q_k} q_j + (P_k(q) - c_k) = 0 \tag{20}$$

where

$$p = (B')^{-1}q - (B')^{-1}a \tag{21}$$

3.2 Results

The previous model will be applied on the 5 most frequented domestic routes in the US on the most recent data (the last quarter of 2016) to simulate the effects of different merger scenarios. These routes can be seen in Table 4. Because mergers can create cost efficiencies, different cases will be considered: when the merging parties enjoy no cost reduction, a 5% cost reduction and a 10% cost reduction. In order to use the already available elasticities, it is required to order airlines in decreasing order according to their

Table 5: Domestic Market Shares, 2016

Airline	Share
Southwest (WN)	19.1%
Delta (DL)	18.3%
American (AA)	16.9%
United (UA)	14.5%
JetBlue (B6)	5.5%
Alaska (AS)	4.6%
US Airways (US)	3%
Spirit (NK)	2.4%
SkyWest (OO)	2.3%
Frontier (F9)	1.9%
Other	11.7%

Table 6: Chicago - New York City

Airline	Price ($)	Quantity	Marginal Cost ($)	Profit ($)
WN	169.56	274274	29.94	38291932
DL	205.27	57135	62.63	8149657
AA	207.67	415959	64.26	59652964
UA	261.14	547425	88.24	94645376
B6	169.06	40811	44.15	5097779
NK	93.27	50698	27.05	3357405
OO	171.36	6027	25.43	879503
S5	235.11	106162	40.37	20673576

national, domestic market share. Table 5 provides domestic market shares of the major U.S. airlines.

3.2.1 Market 1: Chicago - New York City

The "Chicago - New York City" market is the largest domestic market in the U.S.A. The distance between the two cities is 1146 kilometres, or 712 miles. This is considered short haul by Eurocontrol, as it lays below 1500 kilometres (this threshold can vary between institutions and airlines, but this route is always considered as short haul). Table 6 presents the airlines present in this market, with their prices, quantities and estimated marginal costs and profits, ranked according to their domestic market share as in Table 5. Alaska Airlines, US Airways and Frontier Airlines are not present in this market. Kim (2006) considers at most 8 airlines per market, which leaves room for an additional firm, Shuttle America (S5), the largest airline in this particular market that is not present in Table 5. Using mean prices and mean estimated marginal costs on this market, the price elasticity should be:

$$\frac{P - MC}{P} = -\frac{1}{E_d} \Leftrightarrow E_d = -\frac{P}{P - MC} = -1.34 \tag{22}$$

This is consistent with the estimated route level elasticity in Pearce & Smyth (2008) that ranges from -1.2 to -1.5, and is a sign that estimated marginal costs should be correct.
The ranking at the market level is not the same as the one at the national level. Every firms in this market are independent airlines, no airline is owned by another. The original ownership matrix thus is :

$$\Delta = I_{8\times 8} \tag{23}$$

The demand parameters are, rounded:

$$B' = \begin{pmatrix} -1759 & 49 & 107 & 122 & 5 & 1 & 0 & 0 \\ 4 & -240 & -237 & 5 & -10 & -14 & 0 & -3 \\ -1 & -83 & -1115 & -392 & -6 & 6 & -1 & -19 \\ 23 & 31 & -258 & -1408 & -17 & 7 & -1 & -2 \\ 30 & -72 & -83 & -624 & -162 & 41 & 3 & -2 \\ 17 & -198 & 584 & 475 & 79 & -478 & -3 & 51 \\ 4 & -30 & -368 & -638 & 47 & -26 & -24 & 71 \\ 10 & 12 & -444 & -65 & 0 & 28 & 5 & -364 \end{pmatrix} \tag{24}$$

and

$$a = \begin{pmatrix} 555953 \\ 140380 \\ 872681 \\ 1161088 \\ 59992 \\ 85476 \\ 9257 \\ 180900 \end{pmatrix} \tag{25}$$

Mergers will be considered to change the original ownership structure. In this market, a merger between Southwest (WN) and Delta (DL) will translate into $\Delta_{1,2} = \Delta_{2,1} = 1$, when it was $\Delta_{1,2} = \Delta_{2,1} = 0$ pre merger. Indeed, Southwest is ranked first and Delta second. This will be repeated throughout the rest of the paper. Six merger scenarios are considered in Tables 7 to 12. Table 7 corresponds to predicted prices and quantities without cost efficiencies, while Tables 8 and 9 consider efficiencies of respectively 5% and 10% for the merging parties. Tables 10 to 12 present the same but for estimated profits.
Some general observations can be made.
First of all, from Table 7 that shows predicted prices and quantities, as well as their predicted change from the original situation, it can be seen that

Table 7: Chicago - New York City, Prices and Quantities, No Cost Efficiencies

	(1) (WN & DL)		(2) (WN & AA)		(3) (DL & AA)		(4) (WN & UA) & (DL & AA)		(5) (WN & AA) & (DL & UA)		(6) (WN & NK) & (DL & UA)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	169.7	274056.2	169	275398	169.6	274262.1	170.9	271755.9	169	275503.4	170.3	273069.9
	0.08	-0.08	-0.35	0.41	0	0	0.79	-0.92	-0.3	0.45	0.44	-0.44
DL	218.1	51670.1	204.7	56910	159.8	80402.5	160.5	80611.4	234.7	44651.6	235.4	44893.2
	6.26	-9.56	-0.28	-0.39	-22.17	40.72	-21.8	41.09	14.34	-21.85	14.69	-21.43
AA	206.5	413123.4	209.5	410685.3	195	475015.9	194.5	474098.6	206.4	402766.8	204.5	408038.7
	-0.54	-0.68	0.89	-1.27	-6.12	14.2	-6.34	13.98	-0.62	-3.17	-1.51	-1.9
UA	261.5	548340.6	260.8	546498.7	262.7	551882.7	266.7	539825.4	266.6	532927.5	266.9	533824.3
	0.12	0.17	-0.13	-0.17	0.6	0.81	2.13	-1.39	2.08	-2.65	2.23	-2.48
B6	168.7	40703.9	169	40806.1	170.6	41262.6	170.4	41203.2	167.9	40481	167.9	40484.2
	-0.22	-0.26	-0.01	-0.01	0.92	1.11	0.8	0.96	-0.67	-0.81	-0.67	-0.8
NK	93.1	50566	93.3	50711.2	93.8	51091.8	93.8	51100.3	92.9	50421.1	92.8	50436.4
	-0.2	-0.26	0.02	0.03	0.61	0.78	0.62	0.79	-0.43	-0.55	-0.49	-0.52
OO	171.3	6023.2	171.3	6025.1	172.2	6059	172.1	6054.4	170.9	6010.6	171	6012.6
	-0.06	-0.06	-0.03	-0.03	0.48	0.53	0.41	0.46	-0.24	-0.27	-0.21	-0.24
S5	235.1	106143.4	235	106128.9	235.8	106540.8	235.8	106532.7	234.9	106076.5	235	106107.7
	-0.02	-0.02	-0.03	-0.03	0.31	0.36	0.3	0.35	-0.07	-0.08	-0.04	-0.05

Note: in each carrier's row, the first row reports predicted prices and quantities while the second reports their predicted % change.

Table 8: Chicago - New York City, Prices and Quantities, 5% Cost Efficiencies

	(1) (WN & DL)		(2) (WN & AA)		(3) (DL & AA)		(4) (WN & UA) (DL & AA)		(5) (WN & AA) (DL & UA)		(6) (WN & NK) (DL & UA)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	169	275424.1	168.3	276782.9	169.6	274264.4	170.2	273082.3	168.3	276865.3	168.9	275701.4
	-0.34	0.42	-0.76	0.91	0	0	0.38	-0.43	-0.73	0.94	-0.38	0.52
DL	216.8	52197.3	204.9	56989.7	158.3	81281.3	158.8	81398.5	233.6	45115.2	233	45928.1
	5.59	-8.64	-0.18	-0.25	-22.86	42.26	-22.65	42.47	13.81	-21.04	13.5	-19.61
AA	206.6	413366.9	208.5	413426	193.9	478741.8	193.7	478181.5	205.6	406185.5	204.7	408549.7
	-0.5	-0.62	0.41	-0.61	-6.62	15.09	-6.75	14.96	-0.98	-2.35	-1.42	-1.78
UA	261.4	548185.8	261	546900.2	262.9	552315.6	265.2	545127.9	265.1	538093.5	265.3	538056
	0.1	0.14	-0.07	-0.1	0.66	0.89	1.57	-0.42	1.53	-1.7	1.6	-1.71
B6	168.7	40713	169	40806.1	170.7	41279.5	170.6	41243.7	168	40514.6	168	40491.9
	-0.2	-0.24	-0.01	-0.01	0.96	1.15	0.88	1.06	-0.6	-0.73	-0.65	-0.78
NK	93.1	50579.1	93.3	50703.7	93.8	51101.4	93.9	51106.3	92.9	50421.1	92.3	50824.4
	-0.18	-0.23	0.01	0.01	0.62	0.8	0.63	0.81	-0.43	-0.55	-0.99	0.25
OO	171.3	6023.6	171.3	6026.1	172.2	6060.7	172.2	6058	171	6013.7	171.1	6016
	-0.05	-0.06	-0.01	-0.02	0.5	0.56	0.46	0.51	-0.2	-0.22	-0.16	-0.18
S5	235.1	106145.7	235.1	106147.2	235.9	106564.6	235.9	106559.9	235	106099.4	235	106099.1
	-0.01	-0.02	-0.01	-0.01	0.33	0.38	0.32	0.37	-0.05	-0.06	-0.05	-0.06

Table 9: Chicago - New York City, Prices and Quantities, 10% Cost Efficiencies

	(1) (WN & DL)		(2) (WN & AA)		(3) (DL & AA)		(4) (WN & UA) (DL & AA)		(5) (WN & AA) (DL & UA)		(6) (WN & NK) (DL & UA)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	168.3	276792	167.6	278167.9	169.6	274266.8	169.5	274408.7	167.6	278227.3	168.9	275728.5
	-0.75	0.92	-1.18	1.42	0	0	-0.04	0.05	-1.15	1.44	-0.41	0.53
DL	215.4	52724.4	205.1	57069.4	156.9	82160.2	157	82185.7	232.5	45578.9	233.3	45887.5
	4.92	-7.72	-0.08	-0.11	-23.56	43.8	-23.5	43.84	13.29	-20.23	13.66	-19.69
AA	206.7	413610.5	207.5	416166.7	192.9	482467.8	192.8	482264.4	204.9	409604.1	204.7	408597.1
	-0.45	-0.56	-0.08	0.05	-7.12	15.99	-7.16	15.94	-1.34	-1.53	-1.41	-1.77
UA	261.4	548030.9	261.1	547301.6	263	552748.4	263.8	550430.5	263.7	543259.4	263.7	542970
	0.08	0.11	-0.02	-0.02	0.72	0.97	1.01	0.55	0.98	-0.76	0.97	-0.81
B6	168.8	40722.1	169	40806	170.7	41296.4	170.7	41284.3	168.2	40548.3	167.9	40483
	-0.18	-0.22	-0.01	-0.01	0.99	1.19	0.96	1.16	-0.54	-0.64	-0.67	-0.8
NK	93.1	50592.2	93.3	50696.2	93.9	51110.9	93.9	51112.3	92.9	50421.1	91.8	51185.3
	-0.16	-0.21	0	0	0.64	0.81	0.64	0.82	-0.43	-0.55	-1.54	0.96
OO	171.3	6024	171.4	6027.1	172.3	6062.4	172.2	6061.6	171.1	6016.9	171.1	6018.7
	-0.05	-0.05	0	0	0.53	0.59	0.51	0.57	-0.15	-0.17	-0.12	-0.14
S5	235.1	106148.1	235.1	106165.5	235.9	106588.5	235.9	106587.1	235	106122.4	235	106086
	-0.01	-0.01	0	0	0.35	0.4	0.35	0.4	-0.03	-0.04	-0.06	-0.07

Table 10: Chicago - N.Y., Profits, No Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	38298836 0.02	38287039 -0.01	38288595 -0.01	38305577 0.04	38322841 0.08	38328820 0.1
DL	8034368 -1.41	8084449 -0.8	7810040 -4.17	7890339 -3.18	7682963 -5.73	7757262 -4.81
AA	58780974 -1.46	59659315 0.01	62086666 4.08	61749479 3.51	57242764 -4.04	57233368 -4.06
UA	94981191 0.35	94306245 -0.36	96285900 1.73	96330535 1.78	95037122 0.41	95396836 0.79
B6	5069385 -0.56	5096478 -0.03	5218414 2.37	5202463 2.05	5010516 -1.71	5011371 -1.7
NK	3339087 -0.55	3359240 0.05	3412362 1.64	3413551 1.67	3319031 -1.14	3317106 -1.2
OO	878380 -0.13	878933 -0.06	889117 1.09	887746 0.94	874601 -0.56	875184 -0.49
S5	20666156 -0.04	20660415 -0.06	20824668 0.73	20821452 0.72	20639538 -0.16	20651969 -0.1

Table 11: Chicago - N.Y., Profits, 5% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	38707742 1.09	38697961 1.06	38289250 -0.01	38708976 1.09	38726931 1.14	39119657 2.16
DL	8208072 0.72	8107513 -0.52	8033879 -1.42	8080292 -0.85	7855540 -3.61	8104757 -0.55
AA	58855622 -1.34	60966769 2.2	63615247 6.64	63409143 6.3	58731286 -1.55	57387961 -3.8
UA	94924357 0.29	94453153 -0.2	96445939 1.9	98883719 4.48	97555983 3.08	97645527 3.17
B6	5071788 -0.51	5096471 -0.03	5222953 2.46	5213343 2.27	5019380 -1.54	5013391 -1.66
NK	3340900 -0.49	3358200 0.02	3413697 1.68	3414394 1.7	3319029 -1.14	3387483 0.9
OO	878489 -0.12	879229 -0.03	889635 1.15	888817 1.06	875537 -0.45	876197 -0.38
S5	20667094 -0.03	20667690 -0.03	20834202 0.78	20832319 0.77	20648665 -0.12	20648533 -0.12

Table 12: Chicago - New York City, Profits, 10% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	39118811 2.16	39111069 2.14	38289905 -0.01	39114477 2.15	39133134 2.2	39131188 2.19
DL	8383629 2.87	8130609 -0.23	8260713 1.36	8272428 1.51	8030026 -1.47	8119496 -0.37
AA	58930318 -1.21	62286279 4.41	65160041 9.23	65088069 9.11	60236685 0.98	57402307 -3.77
UA	94867539 0.23	94600175 -0.05	96606109 2.07	101468165 7.21	100105519 5.77	100036278 5.7
B6	5074191 -0.46	5096464 -0.03	5227495 2.54	5224234 2.48	5028251 -1.36	5011033 -1.7
NK	3342713 -0.44	3357160 -0.01	3415033 1.72	3415237 1.72	3319028 -1.14	3454772 2.9
OO	878598 -0.1	879525 0	890153 1.21	889889 1.18	876472 -0.34	877032 -0.28
S5	20668032 -0.03	20674965 0.01	20843738 0.82	20843190 0.82	20657795 -0.08	20643325 -0.15

the outcome of mergers strongly depends on which firms are merging. It seems that a single merger between Southwest Airlines (WN) and its closest competitors would have the least impact: Columns (1) and (2) show that Southwest would only slightly adjust its prices and quantities, while Delta (DL) and American (AA) would adjust them more. They would both increase their prices and decrease their quantities if they are the one merging, which is quite expected, and they would also both decrease their prices and quantities if they were not part of the merger with Southwest, yet only slightly. As a whole, if Southwest merges with Delta, 7864 tickets less would be sold in total, and the average ticket would be 0.37$ more expensive. If it merges with American, 5328 tickets less would be sold in total, and the average ticket would be 0.23$ more expensive. Both situations would only slightly harm consumers. Introducing cost efficiencies would only reduce the strength of the price and quantity changes, except if the merger between Southwest and American leads to a 10% cost reduction for both: in this situation American would actually reduce its price and increase its quantities. The percentage changes, however, stay really close to zero, so there probably is not much to infer from these two possible mergers, except that mergers between Southwest and either Delta or American would not have a significant impact on consumer welfare, probably because Southwest differs too much from Delta and American in terms of quality of service, and that the cost efficiency impacts Southwest much less since its marginal costs are already low compared to Delta and American.

Columns (3) and (4) show something interesting: a merger between Delta and American would lead them to decrease their prices and increase their quantities, whether or not their more direct competitors Southwest and United (UA) merge as well. This time the percentage changes are much more important. If Delta and American were to be the only airlines merging, the average ticket would be 5.89$ cheaper, and 88026 additional tickets would be sold. This would be a great improvement for consumers. If Southwest and United were also to merge, then the average ticket price would decrease less: 4.72$ cheaper. Same goes for quantities, that would increase less: 72691 more tickets. It thus seems that there would not be much concerns to have regarding the potential mergers that would follow, since they would only slightly reduce the gains from the merger. However, would the merger be profitable for the firms? The answer is not obvious as, for instance, the Delta entity would suffer from a 4.17% decrease in profits while the American entity would enjoy a 4.08% increase in profits, in case (3), without cost efficiencies. This can be seen in Table 10. The sum of Delta's and American's profits would actually increase by 2,094,084$, so this is a likely scenario that would actually benefit both consumers and airlines, for this particular market. This is probably due to the fact that they would be able to reallocate their production given the demand elasticities, such that their production would be more optimal as a whole. This means that reducing prices and increasing quantities alone is not profitable for neither of the two airlines: Delta tickets and American tickets would then be complement goods. This is either a first limit of our model or a surprising result that might be explained. One possible explanation could be the following. Suppose for instance that a passenger wishes to arrive at 8pm on her outward journey and to return 5 days later, arriving at 6pm. Delta proposes one flight that suits the passenger for the outward journey and so does American for the return journey. If Delta decides to increase its price, the passengers might choose to depart a day earlier, possibly with a different airline, and thus return a day earlier, possibly with a different airline as well. In the end, Delta increasing its price leads to American not selling this ticket. Another possible explanation could be the following. The passenger wishes to fly either Delta or American on her round trip. If Delta increases its ticket price for the outward journey, the passenger might decide to switch to low-cost, e.g. Southwest, for the return journey, so that her budget for the round trip does not change. So Delta increasing its price leads to American not selling its ticket. By coordinating their price decrease, Delta and American create a synergy that is not based on costs but rather on demand. Doing so alone might lead to greater losses on earnings by not proposing the high price than gains by selling more tickets. Again, as expected, the cost efficiencies allow Delta and American to decrease their price and increase their quantities even more.

Columns (5) and (6) show that different merger combinations, other than

one where Delta and American merge, give a result closer to what is usually expected after a merger. It seems that a merger between Delta and United would this time increase prices and reduce quantities. For instance, in case (5), 39653 tickets less would be sold at 2.12$ more. However, the merger would not be profitable for the newly formed entity without cost efficiencies. We might then expect that if Delta and United were to propose a merger, their claim that it would lead to cost efficiencies would be credible, because they would not propose the merger in the first place without it. Would there be enough efficiencies for airlines to pass them on to consumers ? At 5% cost efficiency, the average ticket price would increase by 1.46$, while total quantities offered would decrease by 27901, or 1.86% of the total quantities sold pre-merger. At 10% cost efficiency, the average ticket price would increase by 0.80$, while total quantities offered would decrease by 16150, or 1.08% of the total quantities sold pre-merger. It seems pretty safe to imagine that such a merger could be cleared by competition authorities. We can imagine that there would be reaction from the competitors after such a merger. It is likely that a merger between Southwest and another airline will not greatly change prices and quantities afterwards, even if it merges with another low-cost airline, as can be seen in the tables.
Cost efficiencies always have the expected influence on price and quantity changes, except for Delta in the case of 10% cost efficiencies, Column (6). The price increase and quantity decrease are greater in this case compared to the 5% case. However, the Delta-United entity proposes a lower average price (-1.47$) and a greater total quantity (+4873 seats), so it is important to look at the newly formed entity rather than at the individual parts of this entity. Moreover, in every cases competing airlines not involved in the merger only have mild reactions. The airline that reacts the most to the mergers is JetBlue, another low-cost carrier. Its largest reaction is in case (6) for a 10% cost efficiency gain for prices (-1.55%), and in case (3) for a 10% cost efficiency gain for quantities (+2.16%), which are quite close to zero.

3.2.2 Market 2: Los Angeles - San Francisco

The second largest market is the Los Angeles - San Francisco pair. The two cities are 560 kilometres apart, or 348 miles, so we are once again dealing with a short haul flight. The section will be organised similarly to the previous one. Table 13 presents the market. US Airways is not present in the market. Alaska Airlines, despite being the sixth airline on the national market, appears as a really small player on this route. The price elasticity on this market should be, computed as in equation (22):

$$E_d = -\frac{P}{P - MC} = -1.56 \tag{26}$$

Table 13: Los Angeles - San Francisco

Airline	Price	Quantity	Marginal Costs	Profits
WN	141.97	1689116	31.05	187362856
DL	149.81	161318	64.94	13692672
AA	153.60	92850	66.63	8074776
UA	190.70	348461	91.49	34568342
B6	120.74	172922	45.78	12962561
AS	103.12	397	44.54	23253
NK	74.87	59705	28.04	2795667
OO	177.57	211570	26.37	31989085

This is slightly below the range proposed in Pearce & Smyth (2008), but as an approximation it is still relatively close. The original ownership matrix is again:

$$\Delta = I_{8\times 8} \tag{27}$$

as in equation (23). The demand parameters this time are:

$$B' = \begin{pmatrix} -12944 & 165 & 28 & 93 & 29 & 0 & 1 & 0 \\ 33 & -931 & -72 & 4 & -61 & 0 & -6 & -8 \\ -11 & -319 & -336 & -338 & -34 & 0 & -15 & 54 \\ 194 & 120 & -78 & -1227 & -102 & 0 & -17 & -7 \\ 265 & -287 & -26 & -557 & -966 & 0 & 49 & -7 \\ 98 & -506 & 117 & 273 & 303 & -3 & -30 & 92 \\ 67 & -193 & -188 & -930 & 457 & 0 & -548 & 325 \\ 85 & 48 & -131 & -54 & -1 & 0 & 71 & -962 \end{pmatrix} \tag{28}$$

and

$$a = \begin{pmatrix} 3423838 \\ 396358 \\ 194799 \\ 739085 \\ 254195 \\ 669 \\ 91706 \\ 360515 \end{pmatrix} \tag{29}$$

The first three and the fifth merger scenarios are the same as in the previous subsection. The fourth and sixth one are different and allow to gain additional insight. The same tables are then presented, adapted for this particular market, from Table 14 to Table 19.

Looking at Table 14, one can observe that the outcome of the first three scenarios, as well as the fifth one, are really similar between this market and the previous one. This might signal that what happens in a market

Table 14: Los Angeles - San Francisco, Predicted Prices and Quantities, No Cost Efficiencies

	(1) (WN & DL)		(2) (WN & AA)		(3) (DL & AA)		(4) (WN & DL) (AA & UA)		(5) (WN & AA) (DL & UA)		(6) (WN & B6) (DL & UA)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	142.1	1687954.9	141.5	1695688.2	142	1689027	142	1686167.9	141.6	1696267.8	142.9	1676762.5
	0.07	-0.07	-0.32	0.39	0	-0.01	-0.01	-0.17	-0.28	0.42	0.66	-0.73
DL	158.8	143979.5	149.4	160608.2	119.7	230886.6	160.7	147320.2	168.5	125109.2	168.9	125720.6
	5.98	-10.75	-0.27	-0.44	-20.1	43.13	7.23	-8.68	12.45	-22.45	12.71	-22.07
AA	152.8	92183.8	154.9	91612.2	145.6	105511.9	139.6	108181.5	152.9	89925.2	151.6	91180.6
	-0.52	-0.72	0.85	-1.33	-5.2	13.64	-9.13	16.51	-0.46	-3.15	-1.3	-1.8
UA	190.9	349099.4	190.5	347816.2	191.7	351178.5	175.2	413206.8	194	339488.1	194.2	339821.4
	0.12	0.18	-0.12	-0.19	0.5	0.78	-8.15	18.58	1.74	-2.58	1.82	-2.48
B6	120.5	172462.9	120.7	172901.3	121.7	174747.1	121.5	174413.3	120.1	171640.1	120.4	170907
	-0.2	-0.27	-0.01	-0.01	0.81	1.06	0.66	0.86	-0.57	-0.74	-0.25	-1.17
AS	102.9	395.9	103.1	397.1	103.7	400.1	102.6	394.1	102.7	394.9	102.8	395
	-0.19	-0.27	0.02	0.03	0.54	0.78	-0.5	-0.73	-0.36	-0.52	-0.35	-0.51
NK	74.8	59664.8	74.8	59684.6	75.2	60021.4	75.4	60229	74.7	59545.1	74.8	59587.1
	-0.05	-0.07	-0.03	-0.03	0.4	0.53	0.66	0.88	-0.2	-0.27	-0.15	-0.2
OO	177.5	211534.4	177.5	211506.7	178.1	212231.7	178.2	212376.6	177.5	211415.7	177.5	211484.3
	-0.01	-0.02	-0.03	-0.03	0.28	0.31	0.34	0.38	-0.06	-0.07	-0.04	-0.04

Table 15: Los Angeles - San Francisco, Predicted Prices and Quantities, 5% Cost Efficiencies

	(1) (WN & DL)		(2) (WN & AA)		(3) (DL & AA)		(4) (WN & DL) (AA & UA)		(5) (WN & AA) (DL & UA)		(6) (WN & B6) (DL & UA)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	141.3	1698619	140.8	1706503.6	142	1689047.3	141.2	1696638	140.8	1706877.9	142.2	1687000.9
	-0.44	0.56	-0.82	1.03	0	0	-0.53	0.45	-0.79	1.05	0.14	-0.13
DL	157.4	146441.6	149.6	160985.8	118.3	234921.9	159.4	149970.4	167.4	127256.9	167.7	127727.6
	5.05	-9.22	-0.13	-0.21	-21.07	45.63	6.37	-7.03	11.73	-21.11	11.95	-20.82
AA	152.9	92269.5	153.9	92537.9	144.6	106769.7	138.6	109607.3	152.1	91082.1	151.9	91391.5
	-0.45	-0.63	0.19	-0.34	-5.88	14.99	-9.74	18.05	-0.94	-1.9	-1.13	-1.57
UA	190.9	348950	190.6	348226	191.8	351611.3	173.4	419459	192.6	344728	192.8	345209.1
	0.09	0.14	-0.04	-0.07	0.58	0.9	-9.05	20.37	0.98	-1.07	1.08	-0.93
B6	120.5	172521.3	120.7	172902.5	121.8	174851.9	121.7	174667.3	120.2	171850.8	119.9	172482.3
	-0.18	-0.23	-0.01	-0.01	0.86	1.12	0.77	1.01	-0.48	-0.62	-0.71	-0.25
AS	102.9	396.1	103.1	397	103.7	400.2	102.6	394.1	102.7	394.9	102.7	394.8
	-0.16	-0.23	0	0.01	0.56	0.81	-0.5	-0.73	-0.36	-0.52	-0.39	-0.56
NK	74.8	59670.6	74.9	59699.8	75.2	60047.9	75.4	60287.5	74.8	59593.6	74.7	59581
	-0.04	-0.06	-0.01	-0.01	0.43	0.57	0.74	0.98	-0.14	-0.19	-0.16	-0.21
OO	177.5	211540.8	177.6	211556.8	178.1	212297.3	178.2	212453.8	177.5	211478.7	177.5	211486.1
	-0.01	-0.01	-0.01	-0.01	0.3	0.34	0.37	0.42	-0.04	-0.04	-0.04	-0.04

Table 16: Los Angeles - San Francisco, Predicted Prices and Quantities, 10% Cost Efficiencies

	(1) (WN & DL)		(2) (WN & AA)		(3) (DL & AA)		(4) (WN & DL) (AA & UA)		(5) (WN & AA) (DL & UA)		(6) (WN & B6) (DL & UA)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	140.6	1709283	140.1	1717319.1	142	1689067.7	140.5	1707108.2	140.1	1717487.9	141.4	1697239.3
	-0.94	1.19	-1.33	1.67	0	0	-1.04	1.07	-1.31	1.68	-0.38	0.48
DL	156	148903.7	149.8	161363.4	116.8	238957.1	158.1	152620.7	166.3	129404.7	166.6	129734.6
	4.12	-7.7	0.02	0.03	-22.03	48.13	5.52	-5.39	11.01	-19.78	11.18	-19.58
AA	153	92355.2	152.9	93463.6	143.5	108027.5	137.7	111033.1	151.4	92239.1	152.1	91602.5
	-0.38	-0.53	-0.48	0.66	-6.56	16.35	-10.35	19.58	-1.43	-0.66	-0.97	-1.34
UA	190.8	348800.5	190.8	348635.8	192	352044.2	171.7	425711.2	191.1	349968	191.4	350596.8
	0.06	0.1	0.03	0.05	0.66	1.03	-9.95	22.17	0.22	0.43	0.34	0.61
B6	120.6	172579.7	120.7	172903.6	121.8	174956.7	121.8	174921.4	120.3	172061.6	119.3	174057.6
	-0.15	-0.2	-0.01	-0.01	0.9	1.18	0.89	1.16	-0.38	-0.5	-1.17	0.66
AS	103	396.2	103.1	396.9	103.7	400.3	102.6	394.1	102.7	394.9	102.7	394.6
	-0.13	-0.19	-0.01	-0.02	0.58	0.84	-0.5	-0.73	-0.36	-0.52	-0.42	-0.62
NK	74.8	59676.3	74.9	59715	75.2	60074.4	75.5	60346	74.8	59642	74.7	59574.9
	-0.04	-0.05	0.01	0.02	0.47	0.62	0.81	1.07	-0.08	-0.11	-0.16	-0.22
OO	177.6	211547.2	177.6	211606.8	178.2	212362.9	178.3	212530.9	177.5	211541.7	177.5	211487.8
	-0.01	-0.01	0.02	0.02	0.33	0.37	0.4	0.45	-0.01	-0.01	-0.03	-0.04

Table 17: L.A. - S.F., Profits, No Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	187397908 0.02	187332895 -0.02	187342897 -0.01	187004310 -0.19	187490590 0.07	187554591 0.1
DL	13510362 -1.33	13567650 -0.91	12644115 -7.66	14100547 2.98	12953400 -5.4	13065223 -4.58
AA	7943615 -1.62	8087066 0.15	8333763 3.21	7891023 -2.28	7757373 -3.93	7748114 -4.05
UA	34710049 0.41	34425508 -0.41	35173520 1.75	34568109 0	34806947 0.69	34891710 0.94
B6	12885734 -0.59	12959095 -0.03	13270239 2.37	13213695 1.94	12748591 -1.65	12759801 -1.56
AS	23113 -0.61	23268 0.06	23659 1.74	22881 -1.6	22985 -1.15	22993 -1.12
NK	2791512 -0.15	2793559 -0.08	2828517 1.18	2850175 1.95	2779135 -0.59	2783476 -0.44
OO	31978108 -0.03	31969599 -0.06	32193227 0.64	32238036 0.78	31941576 -0.15	31962685 -0.08

Table 18: L.A. - S.F., Profits, 5% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	189999926 1.41	189949314 1.38	187347461 -0.01	189560266 1.17	190057890 1.44	190082372 1.45
DL	14013333 2.34	13634085 -0.43	13288374 -2.95	14648416 6.98	13451291 -1.76	13542300 -1.1
AA	7960429 -1.42	8382355 3.81	8676842 7.46	8257831 2.27	8092469 0.22	7789028 -3.54
UA	34676850 0.31	34516256 -0.15	35270385 2.03	36290917 4.98	36419901 5.36	36537542 5.7
B6	12895491 -0.52	12959290 -0.03	13288015 2.51	13256722 2.27	12783646 -1.38	13176284 1.65
AS	23133 -0.52	23256 0.01	23674 1.81	22882 -1.6	22985 -1.15	22965 -1.24
NK	2792104 -0.13	2795133 -0.02	2831276 1.27	2856294 2.17	2784142 -0.41	2782847 -0.46
OO	31980083 -0.03	31985007 -0.01	32213502 0.7	32261897 0.85	31960971 -0.09	31963234 -0.08

Table 19: L.A. - S.F., Profits, 10% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	192619751 2.81	192583752 2.79	187352024 -0.01	192133435 2.55	192642528 2.82	192626935 2.81
DL	14525449 6.08	13700683 0.06	13947174 1.86	15206683 11.06	13958482 1.94	14027816 2.45
AA	7977259 -1.21	8681917 7.52	9025664 11.78	8631477 6.89	8433542 4.44	7830047 -3.03
UA	34643667 0.22	34607122 0.11	35367382 2.31	38049491 10.07	38065557 10.12	38217480 10.56
B6	12905252 -0.44	12959484 -0.02	13305803 2.65	13299819 2.6	12818749 -1.11	13598225 4.9
AS	23154 -0.43	23245 -0.04	23689 1.87	22882 -1.6	22986 -1.15	22938 -1.36
NK	2792696 -0.11	2796708 0.04	2834036 1.37	2862419 2.39	2789153 -0.23	2782218 -0.48
OO	31982058 -0.02	32000419 0.04	32233784 0.76	32285767 0.93	31980371 -0.03	31963782 -0.08

will most likely also happen in similar markets, that is at least when the concerned parties are present in both markets. This similarity persists even when cost efficiencies are introduced. For this reason, there is no further analysis to be made regarding these four scenarios as the one from the last subsection also applies here.

However, scenarios (4) and (6) are different. In case (4) the average price decreases by 1.20$ and 65950 more seats are offered in total, even without cost efficiencies. The same phenomenon as in the previous market for cases (3) and (4) thus appears, but it is not in the same proportions. The price decrease is not as important. The effect of the cost efficiencies is still as expected, that is the greater the cost efficiencies, the more average prices decrease and quantities increase. Is it profitable ? Without cost efficiencies, the merging parties in scenario (4) would have different variations of their profits: Southwest and Delta would see their joint profit increase by 49329$ while American and United would see their joint profit decrease by 183987$. The producer surplus would be greatly reduced. However, introducing cost efficiencies of 5% allows all merging firms to increase their profits: American and United would enjoy a profit increase equivalent to its decrease without cost efficiencies, that is a 4.5% increase, while Southwest and Delta would enjoy a 1.5% increase in their joint profits, compared to the case without efficiencies. Overall, prices either decrease more or increase less and quantities either increase more or decrease less when cost efficiencies are introduced, and even more with greater cost efficiencies.

Table 20: Los Angeles - New York City

Airline	Price	Quantities	Marginal Costs	Profits
DL	506.6	271054	59.1	121288494
AA	594.2	181734	60.7	96965772
UA	508.5	393345	83.3	167181664
B6	347.0	288377	41.7	88030798
VX	410.5	211783	53.1	75675957

3.2.3 Market 3: Los Angeles - New York City

The third market corresponds to the city pair Los Angeles - New York City. The distance between the two cities is 3937 kilometres, or 2446 miles. This is very close to the limit set by Eurocontrol between medium haul and long haul, so this market is very different from the first two. The consequence is that, since only direct flights were considered, the market will not necessarily be correctly represented as some airlines do not propose this flight directly, due to the long distance between the two cities. This might be a flaw of this paper, and considering the different flight combinations allowing to go from Los Angeles to New York City (and the other way around) was beyond its scope. However, it will be interesting to see how this lack of representation impacts the predictions. It might be possible to correctly simulate mergers between firms that propose direct flights if direct flights and indirect flights actually are two separate markets. This would actually go along with one of the findings in Berry & Jia (2010): consumers have an increasingly strong preference for direct fligths, which might support the idea of considering them as separate markets. The firms present in the direct flight market can be seen in Table 20. Only Delta, American, United and JetBlue are present from Table 5. Virgin America (VX) was added, as the only other airline exploiting this route directly. Comparing Table 20 with Table 13 for instance, predicted marginal costs appear slightly lower in this market even if the distance is greater and the tickets are more expensive. Either our cost function is not adapted to direct long haul flights, or this is actually true: it might be less costly to add a passenger in a long haul flight than in a short haul flight, as planes are much bigger and transport much more passengers per flights. Moreover, planes for longer haul have different engines (shaft engines, reaction engines, etc.) that are built to be efficient for certain flying distances. The price difference is probably explained by much larger fixed costs (or marginal costs relatively to the flight and not to the seat). The price difference reveals other sources of costs that are not marginal relatively to the passenger but to the flight: there must be an important difference in terms of fuel consumption (surely twice as much), parking fees (that depends on the size of the aircraft, which is bigger, and the time spent on the ground, which is longer), airport services (larger hubs are required at airports, which are more expensive), organisation (more employees are needed to register and help passengers), the aircraft itself, and so on. These flights also do not depart as often in a day as short haul flights. One indication will be whether the predictions make sense or not. An other indication is the estimated price elasticity, which is calculated as:

$$E_d = -\frac{P}{P - MC} = -1.14 \tag{30}$$

This is not more distant from the estimated range in Pearce & Smyth (2008) as was the previous market, so the results might make sense. The merger simulation will be performed with an original ownership matrix that is again the identity matrix (5×5), and the following demand parameters:

$$B' = \begin{pmatrix} -478 & -79 & 8 & -45 & -8 \\ -184 & -234 & 34 & 75 & -12 \\ 54 & 24 & -810 & -62 & -34 \\ -247 & 271 & -176 & -718 & 117 \\ -150 & -103 & -284 & 237 & -355 \end{pmatrix} \tag{31}$$

and

$$a = \begin{pmatrix} 742417 \\ 297135 \\ 958582 \\ 450156 \\ 345206 \end{pmatrix} \tag{32}$$

As in previous subsections, merger simulation results are presented, from Table 21 to Table 26.

Compared to previous markets, these mergers induce much larger reactions from merging parties, on average. Firms reduce their prices in cases (1), (3), (4) and (6), without cost efficiencies and in quite large proportions. Cases (2) and (5) are the only one that generate a price increase. The change proportions (for instance, Delta reduces its price by 40.64% and increases its quantities by 74.92% if it merges with American) are much larger than what we encountered previously. This might be due to the market being more concentrated, that is, in previous markets a single market reduced the number of firms by 12.5% whereas now it is by 20%, and a double merger reduced the number of firms by 25% whereas now it is by 40%. Let us look at the evolution of average prices and total quantities on the market after the different scenarios, firstly without cost efficiencies.
In scenario (1), the average ticket would be sold 62.4$ cheaper and 253793 additional passengers would fly. That is a really important improvement for consumers. In scenario (2) the price would increase by 9.5$ and 55047 tickets less would be sold. Scenario (3) leads to a 0.6$ decrease in prices and

Table 21: Los Angeles - New York City, Predicted Prices and Quantities, No Cost Efficiencies

	(1) (DL & AA)		(2) (DL & UA)		(3) (AA & UA)		(4) (DL & AA) (UA & B6)		(5) (DL & UA) (AA & B6)		(6) (DL & VX)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
DL	300.7	474129.1	567.6	227481	512.9	274874.4	319.8	477106.9	476.1	171343.6	319.1	413332
	-40.65	74.92	12.05	-16.08	1.24	1.41	-36.88	76.02	-6.03	-36.79	-37.01	52.49
AA	529	233242.5	585.6	178894	578.2	188083.2	508.8	227093.7	790.5	108704.8	622.8	191076.3
	-10.98	28.34	-1.46	-1.56	-2.7	3.49	-14.38	24.96	33.02	-40.18	4.8	5.14
UA	504	389269	515.5	387508.7	507.6	393485.2	432.2	468999	513.5	388790.2	510.1	394911.7
	-0.87	-1.04	1.39	-1.48	-0.16	0.04	-14.99	19.23	1.02	-1.16	0.33	0.4
B6	348.5	289761.2	344.5	286163.4	345.8	287354.9	326.9	321096.9	379.1	274607	351.5	292460.9
	0.44	0.48	-0.71	-0.77	-0.33	-0.35	-5.77	11.35	9.25	-4.77	1.31	1.42
VX	413.9	213684.6	409.5	211198.1	410.6	211827.4	412.6	212962	412.8	213087.3	401.7	220137
	0.82	0.9	-0.25	-0.28	0.02	0.02	0.51	0.56	0.56	0.62	-2.14	3.94

Table 22: Los Angeles - New York City, Prices and Quantities, 5% Cost Efficiencies

	(1) (DL & AA)		(2) (DL & UA)		(3) (AA & UA)		(4) (DL & AA) (UA & B6)		(5) (DL & UA) (AA & B6)		(6) (DL & VX)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
DL	299.1	475928.6	566.3	228169.7	513.1	274981.6	318.8	478991.4	474.9	172577.5	317.5	414936
	-40.95	75.58	11.79	-15.82	1.27	1.45	-37.08	76.71	-6.25	-36.33	-37.33	53.08
AA	528	233843	585.7	178941.9	577.2	188462	507.2	227516.3	789.8	109180.1	623.1	191188.6
	-11.15	28.67	-1.43	-1.54	-2.87	3.7	-14.64	25.19	32.91	-39.92	4.86	5.2
UA	503.9	389226.7	513.4	389455.4	505.5	395443	430	471277.4	513.5	388707.2	510.3	395152.8
	-0.88	-1.05	1	-0.99	-0.56	0.53	-15.41	19.81	1.01	-1.18	0.38	0.46
B6	348.5	289744.8	344.6	286281.2	345.8	287374.7	326.3	321987.4	379.1	274483.9	351.4	292355.1
	0.44	0.47	-0.67	-0.73	-0.32	-0.35	-5.96	11.66	9.27	-4.82	1.27	1.38
VX	413.9	213701.3	409.6	211257.4	410.7	211881.4	412.6	212958.2	412.8	213108	400.8	220710.9
	0.83	0.91	-0.23	-0.25	0.04	0.05	0.51	0.55	0.57	0.63	-2.35	4.22

Table 23: Los Angeles - New York City, Predicted Prices and Quantities, 10% Cost Efficiencies

	(1) (DL & AA)		(2) (DL & UA)		(3) (AA & UA)		(4) (DL & AA) (UA & B6)		(5) (DL & UA) (AA & B6)		(6) (DL & VX)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
DL	297.6	477728	565	228858.3	513.2	275088.7	317.8	480875.8	473.8	173811.4	315.9	416540
	-41.26	76.25	11.53	-15.57	1.31	1.49	-37.28	77.41	-6.47	-35.88	-37.64	53.67
AA	527	234443.5	585.9	178989.9	576.2	188840.8	505.7	227938.8	789.1	109655.4	623.5	191301
	-11.31	29	-1.41	-1.51	-3.03	3.91	-14.9	25.42	32.79	-39.66	4.92	5.26
UA	503.9	389184.3	511.4	391402.1	503.5	397400.9	427.9	473555.9	513.5	388624.2	510.6	395393.9
	-0.88	-1.06	0.6	-0.49	-0.96	1.03	-15.83	20.39	1.01	-1.2	0.44	0.52
B6	348.5	289728.5	344.8	286399	345.9	287394.4	325.7	322878	379.2	274360.8	351.3	292249.3
	0.43	0.47	-0.63	-0.69	-0.31	-0.34	-6.14	11.96	9.29	-4.86	1.24	1.34
VX	413.9	213718.1	409.7	211316.7	410.8	211935.5	412.6	212954.5	412.9	213128.8	400	221284.8
	0.83	0.91	-0.2	-0.22	0.07	0.07	0.5	0.55	0.58	0.64	-2.56	4.49

Table 24: L.A. - N.Y.C., Profits, No Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	114519050 -5.58	115673524 -4.63	124719548 2.83	124344657 2.52	71434381 -41.1	107445312 -11.41
AA	109224166 12.64	93898972 -3.16	97336321 0.38	101763350 4.95	79333654 -18.18	107401531 10.76
UA	163734441 -2.06	167448964 0.16	166928101 -0.15	163595745 -2.14	167255637 0.04	168516245 0.8
B6	88898200 0.99	86652486 -1.57	87393024 -0.72	91589819 4.04	92642259 5.24	90602237 2.92
VX	77074428 1.85	75248402 -0.56	75708447 0.04	76541506 1.14	76633788 1.27	76728043 1.39

Table 25: L.A. - N.Y.C., Profits, 5% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
DL	115623106 -4.67	116397531 -4.03	124816481 2.91	125773232 3.7	72266048 -40.42	108433453 -10.6
AA	109986923 13.43	93950349 -3.11	97918828 0.98	102288483 5.49	79935345 -17.56	107530314 10.9
UA	163698818 -2.08	169127274 1.16	168596625 0.85	165346857 -1.1	167213301 0.02	168722082 0.92
B6	88887930 0.97	86725564 -1.48	87405334 -0.71	92308751 4.86	92620091 5.21	90535141 2.84
VX	77086807 1.86	75291680 -0.51	75748037 0.1	76538741 1.14	76649061 1.29	77324059 2.18

Table 26: L.A. - N.Y.C., Profits, 10% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
DL	116732224 -3.76	117123795 -3.43	124913452 2.99	127209183 4.88	73102252 -39.73	109426009 -9.78
AA	110752154 14.22	94001739 -3.06	98502889 1.59	102814863 6.03	80539255 -16.94	107659174 11.03
UA	163663198 -2.1	170813953 2.17	170273446 1.85	167107216 -0.04	167170968 -0.01	168928045 1.04
B6	88877661 0.96	86798673 -1.4	87417644 -0.7	93030254 5.68	92597906 5.19	90468070 2.77
VX	77099187 1.88	75334970 -0.45	75787638 0.15	76535976 1.14	76664335 1.31	77922135 2.97

a 9332 increase in passengers. Scenario (4) generates an impressive 80$ decrease in prices, and 360965 additional passengers. Prices would increase by 14$ and quantities decrease by 189760 in scenario (5). Finally, scenario (6) leads to a 44$ price decrease and a 165624 passengers increase. Obviously, competition authorities would only wish for scenario (1), (4) or (6). Scenario (3) generates an increase so close to zero that we will not focus on it. Are scenarios (1), (4) and (6) profitable for firms ? In scenario (1), the newly formed Delta-American entity would increase its joint profit by 5488950$. In scenario (4), this same entity would increase its profits by 7853741$, while the United-JetBlue entity would loose 26898$ in joint profits. In both cases, the Delta-American entity increases its profits by reducing prices and increasing its quantities, just like in the two previous markets. This seems like a good sign that our model has some strength, because a merger between the two same firms has a similar effects in all markets (which have different structures), and whether or not other firms also merge (here it is United with JetBlue, but in Market 1 it was Southwest with United). This signals that there might be too much entry, a business-stealing effect that can be found in the model of circular city from Salop (1979), with horizontal competition. This also suggests that fixed costs should probably be taken into account in an improvement of this paper. It seems coherent with the wave of mergers the airline industry faced in the U.S.A. after the deregulation of the industry in the late 70s: the number of airlines exploded, facilitated by the possibility to rent planes, then the series of mergers tend to push the number of airlines to its optimal level. We can thus expect more mergers to come.

Introducing cost efficiencies allows the United-JetBlue entity to increase their profits, so that scenario (4) becomes profitable for all merging parties, and is actually even better than scenario (1) for consumers. In all cases, it does not allow a merger that was harmful without cost efficiencies to become beneficial, it simply makes them less harmful. The beneficial mergers on the opposite get even more beneficial, but not dramatically: for instance, the merger between Delta and American would lead to an additional decrease in prices of 1.4$ and an additional increase in quantities of 4716 seats with 10% cost efficiencies. If United and JetBlue were also to merger, then it would be by 2.4$ and 10944 passengers.

3.2.4 Market 4: Chicago - Los Angeles

This fourth market, the city pair Chicago - Los Angeles, is a medium haul market. Indeed, the distance between Chicago and Los Angeles is 2803 kilometres, or 1742 miles, around 5 times the distance between San Francisco and Los Angeles for instance. Similarly to the previous market, the greater distance means less airlines represented in the market for direct flights. Table 27 presents the firms exploiting this market. The estimated price elasticity

Table 27: Chicago - Los Angeles

Airline	Price	Quantities	Marginal Costs	Profits
WN	142.0	1689116	31.0	187362857
AA	153.6	92850	66.6	8074776
UA	190.7	348461	91.5	34568342
NK	74.9	59705	28.0	2795667
VX	180.0	187157	58.4	22762781

is:

$$E_d = -\frac{P}{P - MC} = -1.59 \tag{33}$$

This is the most distant from the 1.2-1.5 range so far. The demand parameters are the following:

$$B' = \begin{pmatrix} -19405 & 69 & -145 & -21 & -16 \\ 1353 & -669 & -23 & -3 & -17 \\ 815 & 57 & -1915 & 4 & -4 \\ 1579 & 123 & 954 & -919 & 102 \\ 957 & 7 & -21 & 34 & -941 \end{pmatrix} \tag{34}$$

and

$$a = \begin{pmatrix} 3790376 \\ 164623 \\ 670090 \\ 125166 \\ 354475 \end{pmatrix} \tag{35}$$

Tables 28 to 33 present the results of the merger simulations.
As can be seen from Table 28, firms' reactions are much more mild than in the previous market. Moreover, none of the potential merger scenarios presented here can be beneficial to consumers without cost efficiencies. With 5% cost efficiencies, the merger between American and United (scenario (3)) stops being harmful, but the price reduction is really close to zero (-0.07$). It is the only one at this level of cost efficiencies, and at the 10% level. This merger would also be profitable for the merging parties, starting from the 5% level as well, making an additional 1744342$ in joint profits. This is a 4% profit increase. At the 10% level there is a 8% increase in joint profits. This is very similar to what happens in the previous market when the same firms merge, so once again it shows some strength of the simulation model. A similar case appeared earlier, so we can again believe that if American and United propose a merger, then necessarily there will be cost efficiencies, because the new entity would suffer from joint profit losses otherwise. This shows how merger simulation can assess the credibility of the arguments of the firms proposing the merger.

In every cases, cost efficiencies again induce a greater price reduction or lower price increase, and a greater quantity increase or lower quantity decrease.

3.2.5 Market 5: Miami - New York City

The last market that we will consider in this paper concerns the city pair Miami - New York City. The two cities are 1753 kilometres apart, or 1089 miles. This is considered medium haul but it is very close to the limit between short and medium. Mechanically, more firms are present in the direct flights market. They are presented in Table 34. The estimated elasticity is:

$$E_d = -\frac{P}{P - MC} = -1.37 \tag{36}$$

It is very well within the range previously proposed. The demand parameters used are the following:

$$B' = \begin{pmatrix} -215 & 305 & 123 & 54 & 62 & 4 & 1 & 0 \\ 1 & -1606 & -289 & 3 & -122 & -55 & -2 & 0 \\ 0 & -550 & -1344 & -183 & -69 & 26 & -5 & -2 \\ 3 & 226 & -343 & -725 & -222 & 31 & -6 & 0 \\ 3 & -390 & -82 & -237 & -1513 & 128 & 12 & 0 \\ 2 & -1222 & 658 & 207 & 845 & -1713 & -13 & 6 \\ 1 & -358 & -807 & -540 & 976 & -181 & -181 & 16 \\ 2 & 123 & -775 & -44 & -3 & 158 & 33 & -63 \end{pmatrix} \tag{37}$$

and

$$a = \begin{pmatrix} 76225 \\ 978139 \\ 1113117 \\ 572401 \\ 724001 \\ 346461 \\ 40411 \\ 22924 \end{pmatrix} \tag{38}$$

Table 35 to Table 40 present the results of the same merger simulations as in the Los Angeles - San Francisco market.

It turns out that the outcome is very similar to the one of the Los Angeles - San Francisco market. This greatly supports the hypothesis that the outcome of mergers will be similar in different markets given that the same or similar firms interact on this market.

Table 28: Chicago - Los Angeles, Prices and Quantities, No Cost Efficiencies

	(1) (WN & AA)		(2) (WN & UA)		(3) (AA & UA)		(4) (WN & AA) (UA & NK)		(5) (WN & NK) (AA & UA)		(6) (WN & VX)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	146.1	1629694.4	145.6	1629031.9	142.2	1692399.7	146.5	1634601.1	145.9	1632372.5	146.6	1616654.9
	2.93	-3.52	2.58	-3.56	0.15	0.19	3.18	-3.23	2.78	-3.36	3.25	-4.29
AA	157.5	89412	153.6	92833.7	159	87586.4	158	89899.3	159.1	87640.1	153.8	93013.6
	2.54	-3.7	-0.01	-0.02	3.54	-5.67	2.89	-3.18	3.55	-5.61	0.11	0.18
UA	190.5	348001.7	187	358757.5	189.8	350969.6	201.8	314609.5	189.4	349893.2	190.6	348030.2
	-0.08	-0.13	-1.93	2.95	-0.48	0.72	5.8	-9.71	-0.67	0.41	-0.08	-0.12
NK	74.8	59646.8	74.8	59653.8	74.8	59686.2	75	59516	73.8	60906.3	74.8	59631.2
	-0.07	-0.1	-0.06	-0.09	-0.02	-0.03	0.13	-0.32	-1.49	2.01	-0.08	-0.12
VX	179.9	187066.7	180	187131.4	179.9	187088.5	179.9	187033.8	179.9	186975.9	179.1	188291
	-0.04	-0.05	-0.01	-0.01	-0.03	-0.04	-0.05	-0.07	-0.07	-0.1	-0.48	0.61

Table 29: Chicago - Los Angeles, Prices and Quantities, 5% Cost Efficiencies

	(1) (WN & AA)		(2) (WN & UA)		(3) (AA & UA)		(4) (WN & AA) (UA & NK)		(5) (WN & NK) (AA & UA)		(6) (WN & VX)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	145.3	1640693.8	144.8	1640054.8	142.1	1690657.1	145.6	1644314.9	145	1642120	145.8	1628195.5
	2.35	-2.87	2	-2.9	0.07	0.09	2.53	-2.65	2.13	-2.78	2.67	-3.61
AA	156.1	90698.6	153.5	92723.8	157.6	88760.1	156.5	91054.8	157.6	88730.6	153.7	92975.5
	1.63	-2.32	-0.09	-0.14	2.63	-4.4	1.88	-1.93	2.58	-4.44	0.09	0.14
UA	190.6	348104.9	185.2	364478.8	187.9	356611.8	199.9	319452.6	187.4	355181.3	190.6	348110.8
	-0.06	-0.1	-2.91	4.6	-1.46	2.34	4.84	-8.32	-1.71	1.93	-0.06	-0.1
NK	74.8	59660	74.8	59658.9	74.9	59686.4	74.4	60260.5	73.1	61660.3	74.8	59611.9
	-0.05	-0.08	-0.05	-0.08	-0.02	-0.03	-0.68	0.93	-2.31	3.28	-0.1	-0.16
VX	179.9	187092.6	180	187146.3	180	187112.7	179.9	187023.4	179.9	186964.8	177.9	190007.6
	-0.03	-0.03	0	-0.01	-0.02	-0.02	-0.05	-0.07	-0.08	-0.1	-1.15	1.52

Table 30: Chicago - Los Angeles, Prices and Quantities, 10% Cost Efficiencies

	(1) (WN & AA)		(2) (WN & UA)		(3) (AA & UA)		(4) (WN & AA) (UA & NK)		(5) (WN & NK) (AA & UA)		(6) (WN & VX)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	144.5	1651693.2	144	1651077.7	142	1688914.5	144.6	1654028.8	144.1	1651867.4	144.9	1639736.1
	1.76	-2.22	1.42	-2.25	-0.01	-0.01	1.88	-2.08	1.47	-2.21	2.09	-2.92
AA	154.7	91985.2	153.3	92613.9	156.2	89933.7	154.9	92210.2	156.1	89821.2	153.7	92937.5
	0.71	-0.93	-0.16	-0.25	1.72	-3.14	0.87	-0.69	1.6	-3.26	0.06	0.09
UA	190.6	348208	183.3	370200.1	186	362254	198.1	324295.6	185.5	360469.4	190.6	348191.4
	-0.04	-0.07	-3.88	6.24	-2.44	3.96	3.88	-6.93	-2.75	3.45	-0.05	-0.08
NK	74.8	59673.3	74.8	59663.9	74.9	59686.7	73.7	61005	72.5	62414.4	74.8	59592.6
	-0.04	-0.05	-0.05	-0.07	-0.02	-0.03	-1.49	2.18	-3.14	4.54	-0.13	-0.19
VX	180	187118.6	180	187161.1	180	187136.9	179.9	187013.1	179.8	186953.7	176.7	191724.1
	-0.02	-0.02	0	0	-0.01	-0.01	-0.06	-0.08	-0.08	-0.11	-1.81	2.44

Table 31: Chicago - L.A., Profits, No Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	187550687 0.1	186670967 -0.37	188085385 0.39	188703660 0.72	187521014 0.08	186793312 -0.3
AA	8125284 0.63	8071775 -0.04	8093040 0.23	8217587 1.77	8099990 0.31	8104973 0.37
UA	34469472 -0.29	34270526 -0.86	34494057 -0.21	34690939 0.35	34262287 -0.89	34475596 -0.27
NK	2790029 -0.2	2790706 -0.18	2793844 -0.07	2792703 -0.11	2784083 -0.41	2788520 -0.26
VX	22739870 -0.1	22756281 -0.03	22745414 -0.08	22731533 -0.14	22716862 -0.2	22737538 -0.11

Table 32: Chicago - L.A., Profits, 5% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	190002893 1.41	189131100 0.94	187701777 0.18	190858468 1.87	189661520 1.23	189311582 1.04
AA	8416746 4.24	8051523 -0.29	8372908 3.69	8485353 5.08	8363428 3.57	8097940 0.29
UA	34491667 -0.22	35804991 3.58	36014553 4.18	36101998 4.44	35700840 3.28	34492943 -0.22
NK	2791311 -0.16	2791196 -0.16	2793868 -0.06	2875475 2.85	2866960 2.55	2786650 -0.32
VX	22746455 -0.07	22760057 -0.01	22751546 -0.05	22728908 -0.15	22714045 -0.21	23271643 2.24

Table 33: Chicago - L.A., Profits, 10% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	192471005 2.73	191607323 2.27	187318561 -0.02	193025485 3.02	191814143 2.38	191846648 2.39
AA	8713160 7.91	8031297 -0.54	8657309 7.21	8757235 8.45	8630865 6.89	8090911 0.2
UA	34513870 -0.16	37370471 8.11	37565615 8.67	37539649 8.6	37166810 7.52	34510294 -0.17
NK	2792593 -0.11	2791686 -0.14	2793891 -0.06	2959428 5.86	2951021 5.56	2784781 -0.39
VX	22753041 -0.04	22763834 0	22757678 -0.02	22726282 -0.16	22711228 -0.23	23811654 4.61

Table 34: Miami - New York City

Airline	Price	Quantity	Marginal Cost	Profit
WN	190.6	37605	29.4	6060899
DL	214.4	398103	61.5	60899007
AA	220.0	530561	63.1	83236640
UA	250.3	269873	86.6	44171872
B6	219.7	492518	43.3	86881907
NK	105.6	205493	26.5	16235559
F9	100.0	26309	32.3	1780528
VX	171.8	13453	55.2	1567632

Table 35: Miami - New York City, Prices and Quantities, No Cost Efficiencies

	(1) (WN & DL)		(2) (WN & AA)		(3) (DL & AA)		(4) (WN & DL) (AA & UA)		(5) (WN & AA) (DL & UA)		(6) (WN & B6) (DL & UA)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	190.7	37574.7	189.9	37754.1	190.6	37603.7	190.6	37534.3	190	37768.7	192	37321.3
	0.08	-0.08	-0.34	0.4	0	0	0	-0.19	-0.3	0.44	0.73	-0.75
DL	228	360506.9	213.8	396560.6	167.9	554035.7	231.2	368500	244.6	314852.4	245.2	316191.5
	6.33	-9.44	-0.29	-0.39	-21.71	39.17	7.8	-7.44	14.07	-20.91	14.35	-20.58
AA	218.7	526826	222	523616.6	205.7	608040.7	196.6	621578.6	218.6	513396.7	216.6	520442.9
	-0.57	-0.7	0.93	-1.31	-6.47	14.6	-10.62	17.15	-0.62	-3.24	-1.53	-1.91
UA	250.6	270337.7	250	269403.9	251.9	272192.2	228	318243.2	255.7	262288.3	255.9	262532.6
	0.13	0.17	-0.13	-0.17	0.63	0.86	-8.9	17.92	2.16	-2.81	2.25	-2.72
B6	219.2	491257	219.7	492460.8	221.8	497697.6	221.4	496764.2	218.2	488695.3	219	486682.5
	-0.22	-0.26	-0.01	-0.01	0.92	1.05	0.75	0.86	-0.68	-0.78	-0.33	-1.18
NK	105.3	204961.1	105.6	205546.2	106.2	207020.5	105	204040.4	105.1	204414.8	105.1	204443.7
	-0.21	-0.26	0.02	0.03	0.6	0.74	-0.57	-0.71	-0.42	-0.52	-0.41	-0.51
F9	99.9	26291.3	99.9	26300	100.4	26458	100.7	26549.4	99.7	26232.3	99.8	26250.8
	-0.05	-0.07	-0.03	-0.03	0.45	0.57	0.72	0.91	-0.23	-0.29	-0.17	-0.22
VX	171.8	13450.4	171.7	13448.5	172.3	13504.7	172.4	13514.2	171.7	13441.4	171.7	13446.3
	-0.01	-0.02	-0.03	-0.03	0.29	0.38	0.35	0.45	-0.07	-0.09	-0.04	-0.05

Table 36: Miami - New York City, Prices and Quantities, 5% Cost Efficiencies

	(1) (WN & DL)		(2) (WN & AA)		(3) (DL & AA)		(4) (WN & DL) (AA & UA)		(5) (WN & AA) (DL & UA)		(6) (WN & B6) (DL & UA)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	190	37736.3	189.2	37917.9	190.6	37604	189.8	37693	189.3	37929.3	190.6	37631.2
	-0.28	0.35	-0.71	0.83	0	0	-0.38	0.23	-0.67	0.86	0	0.07
DL	226.7	363895.2	214	397072.4	166.5	559621.5	229.9	372113.3	243.6	317699.9	242.7	322195
	5.71	-8.59	-0.19	-0.26	-22.36	40.57	7.21	-6.53	13.58	-20.2	13.18	-19.07
AA	218.8	527128.6	221	526924.2	204.7	612542.2	195.7	626788.7	217.9	517576.3	216.9	521533.5
	-0.52	-0.65	0.47	-0.69	-6.94	15.45	-11.05	18.14	-0.95	-2.45	-1.37	-1.7
UA	250.6	270266.7	250.1	269592.1	252	272392.8	226.3	321365.8	254.3	264934.3	254.5	265029.7
	0.11	0.15	-0.08	-0.1	0.68	0.93	-9.57	19.08	1.59	-1.83	1.67	-1.79
B6	219.3	491358	219.7	492461.7	221.8	497881.4	221.6	497234.8	218.4	489087.1	218.5	489035
	-0.21	-0.24	-0.01	-0.01	0.95	1.09	0.84	0.96	-0.61	-0.7	-0.55	-0.71
NK	105.4	205010.2	105.6	205518.7	106.2	207056.4	104.9	204038.9	105.1	204412.9	105.1	204445.4
	-0.19	-0.23	0.01	0.01	0.61	0.76	-0.57	-0.71	-0.42	-0.53	-0.41	-0.51
F9	99.9	26292.9	100	26304.3	100.4	26465.4	100.7	26566.7	99.8	26246.7	99.8	26253.6
	-0.05	-0.06	-0.01	-0.02	0.47	0.59	0.77	0.98	-0.19	-0.24	-0.17	-0.21
VX	171.8	13450.7	171.8	13450.8	172.3	13507.7	172.4	13517.8	171.7	13444.3	171.7	13446.8
	-0.01	-0.02	-0.01	-0.02	0.31	0.41	0.37	0.48	-0.05	-0.06	-0.03	-0.05

Table 37: Miami - New York City, Prices and Quantities, 10% Cost Efficiencies

	(1) (WN & DL)		(2) (WN & AA)		(3) (DL & AA)		(4) (WN & DL) (AA & UA)		(5) (WN & AA) (DL & UA)		(6) (WN & B6) (DL & UA)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	189.3	37898	188.5	38081.7	190.6	37604.3	189.1	37851.6	188.6	38089.9	190.5	37633.3
	-0.65	0.78	-1.08	1.27	0	0	-0.75	0.66	-1.05	1.29	-0.02	0.08
DL	225.3	367283.5	214.2	397584.2	165.1	565207.3	228.7	375726.6	242.5	320547.3	242.9	321317.4
	5.08	-7.74	-0.1	-0.13	-23.02	41.98	6.63	-5.62	13.1	-19.48	13.27	-19.29
AA	218.9	527431.3	220	530231.9	203.6	617043.7	194.7	631998.8	217.1	521755.9	217.1	522050
	-0.47	-0.59	0	-0.06	-7.42	16.3	-11.48	19.12	-1.28	-1.66	-1.29	-1.6
UA	250.5	270195.8	250.2	269780.2	252.1	272593.5	224.7	324488.5	252.8	267580.2	253	267846.4
	0.09	0.12	-0.03	-0.03	0.74	1.01	-10.23	20.24	1.01	-0.85	1.09	-0.75
B6	219.3	491458.9	219.7	492462.6	221.9	498065.2	221.8	497705.4	218.6	489478.9	218	491220.3
	-0.19	-0.22	-0.01	-0.01	0.98	1.13	0.92	1.05	-0.54	-0.62	-0.8	-0.26
NK	105.4	205059.4	105.6	205491.2	106.2	207092.2	104.9	204037.4	105.1	204411.1	105.1	204346.3
	-0.17	-0.21	0	0	0.63	0.78	-0.57	-0.71	-0.42	-0.53	-0.45	-0.56
F9	99.9	26294.5	100	26308.6	100.5	26472.8	100.8	26584	99.8	26261	99.8	26253.6
	-0.04	-0.06	0	0	0.49	0.62	0.83	1.05	-0.14	-0.18	-0.17	-0.21
VX	171.8	13451	171.8	13453	172.3	13510.7	172.4	13521.4	171.7	13447.2	171.7	13446.8
	-0.01	-0.01	0	0	0.33	0.43	0.39	0.51	-0.03	-0.04	-0.04	-0.05

Table 38: Miami - N.Y.C., Profits, No Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	6061971 0.02	6060228 -0.01	6060492 -0.01	6049168 -0.19	6065894 0.08	6067060 0.1
DL	60043484 -1.4	60420071 -0.79	58956836 -3.19	62533633 2.68	57663978 -5.31	58096056 -4.6
AA	81994223 -1.49	83223048 -0.02	86742304 4.21	82991781 -0.29	79849182 -4.07	79892532 -4.02
UA	44333377 0.37	44009121 -0.37	44980878 1.83	45002019 1.88	44349664 0.4	44446382 0.62
B6	86418497 -0.53	86860870 -0.02	88798399 2.21	88451489 1.81	85480876 -1.61	85502109 -1.59
NK	16148376 -0.54	16244296 0.05	16487236 1.55	15998023 -1.46	16059076 -1.09	16063789 -1.06
F9	1777937 -0.15	1779213 -0.07	1802433 1.23	1815953 1.99	1769302 -0.63	1772009 -0.48
VX	1567000 -0.04	1566510 -0.07	1580460 0.82	1582808 0.97	1564766 -0.18	1565980 -0.11

Table 39: Miami - N.Y.C., Profits, 5% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	6117057 0.93	6115604 0.9	6060586 -0.01	6103220 0.7	6120180 0.98	6173266 1.85
DL	61236555 0.55	60578786 -0.53	60488495 -0.67	63822136 4.8	58829861 -3.4	60324332 -0.94
AA	82094554 -1.37	84870165 1.96	88672984 6.53	85076841 2.21	81751123 -1.78	80249692 -3.59
UA	44308706 0.31	44074366 -0.22	45051222 1.99	46297466 4.81	45562931 3.15	45636538 3.32
B6	86455539 -0.49	86861189 -0.02	88866801 2.28	88626315 2.01	85623942 -1.45	86740572 -0.16
NK	16156419 -0.49	16239776 0.03	16493165 1.59	15997772 -1.46	16058772 -1.09	16064074 -1.06
F9	1778171 -0.13	1779838 -0.04	1803531 1.29	1818512 2.13	1771399 -0.51	1772408 -0.46
VX	1567073 -0.04	1567077 -0.04	1581206 0.87	1583706 1.03	1565487 -0.14	1566109 -0.1

Table 40: Miami - N.Y.C, Profits, 10% Cost Efficiencies

	(1)	(2)	(3)	(4)	(5)	(6)
WN	6172392 1.84	6171231 1.82	6060679 0	6157512 1.59	6174707 1.88	6174520 1.87
DL	62441334 2.53	60737709 -0.26	62038865 1.87	65123755 6.94	60007294 -1.46	60270371 -1.03
AA	82194946 -1.25	86531360 3.96	90622603 8.87	87185000 4.74	83673283 0.52	80419127 -3.38
UA	44284042 0.25	44139660 -0.07	45121620 2.15	47609507 7.78	46791495 5.93	46893468 6.16
B6	86492589 -0.45	86861508 -0.02	88935229 2.36	88801314 2.21	85767127 -1.28	87918825 1.19
NK	16164464 -0.44	16235257 0	16499095 1.62	15997521 -1.47	16058468 -1.09	16047896 -1.16
F9	1778406 -0.12	1780463 0	1804630 1.35	1821074 2.28	1773497 -0.39	1772414 -0.46
VX	1567146 -0.03	1567644 0	1581952 0.91	1584603 1.08	1566208 -0.09	1566099 -0.1

4 Conclusion

As a safety check, the same merger simulations were performed using a general pricing model rather than a quantity setting model. As expected regarding the elements stressed in the introduction, the results did not make much sense: all percentage changes were extremely close to zero (in absolute value, in the e^{-14} to e^{-10} range). An example for Market 1 is provided in the Appendix, to be compared with Table 7. This should confirm that the quantity game is indeed a safer choice when studying the airline industry.
Several steps were needed to perform these merger simulations. First of all, a cost function had to be estimated, based on data aggregated to the airline, national and quarterly level. The quantity variable used was the number of passengers. Different motivated explanatory variables, whose construction was detailed, were also used to control for commonly accepted cost drivers, as well as time and airline dummies. The cost function estimation was performed using a standard Ordinary Least Square method, in logarithms, that allowed to recover the marginal cost function. The results of the estimation appeared quite robust, and the estimated Lerner index for the markets seemed coherent with the elasticities already estimated. Moreover, low-cost airlines were indeed found to have a cheaper technology than standard airlines. Additionally, airline and market specific linear demand functions were recovered using previously estimated own and cross price elasticities.
The merger simulations were then based on a general quantity game, derived from the profit maximization of airline groups, that is joint profit maximization. This required matrix form computations that were presented. These simulations were then performed on the top five U.S. domestic markets, each time with six different merger scenarios envisaged. Some mergers scenarios were repeated across markets, and others were not. This allowed for different kind of comparisons, across markets and within markets. Within each markets and for each scenarios, three different cases were simulated regarding cost efficiencies, to investigate the extent to which airlines would pass them on to consumers.
Several results are worth stressing from this exercise. All markets are not similar, and the definition of this market is important. In our case we defined markets as direct flights between domestic city pairs. This can obviously be improved but was beyond the scope of the paper. Whether or not using these markets is sufficient to assess the outcome of mergers is not clear. Indeed, we saw that the number of airlines present in a market diminishes with the distance between the two cities, as more indirect flights are proposed. Moreover, performing the simulation in a single market is already quite tedious and computationally intensive. Investigating the nation-wide impact of mergers between airlines based on market-level simulations thus

appears as a complex exercise, as it would require to perform the simulation on all markets, which are moreover difficult to define individually. It appears however that the outcome of merger simulations is similar between markets that have close characteristics, such as the present airlines, their number and their type (standard vs. low-cost), or the distance. If this turns out to be true (it would require more simulations to assess this), then it might be possible to perform merger simulations on a few representative markets, and weight their outcome to obtain a credible idea for all domestic markets. Another important point is the heterogeneity of merger outcomes between scenarios. From one scenario to the other, but not from one market to a similar one, the absolute changes in prices, quantities and profits range from 0% to more than 75%. This stresses the importance of considering airlines as heterogeneous goods. It however generates surprising results. For instance, the fact that some merging airlines would reduce their prices and increase their quantities even without cost efficiencies. A few possible explanations were proposed, but it might rely more on the point made before, that is market definition. How do passengers really plan their trip ? The fact that some passengers can fix a budget for the round trip, and try to get the best service for that budget, shows that some airlines can be considered complements: for instance, standard airlines can be complements between each other, while they can be substitutes with low-cost airlines. This might be true and would explain the U.S. airline consolidation. It is also possible that the market definition is again not correct: should low-cost and standard airlines be considered in the same market ? It is worth noting that all negative price changes without cost efficiencies are really close to zero, except for the merger between Delta and American, so they might instead be considered as an approximated zero. Regarding the merger between Delta and American, a strategic decision was recently observed: soon after Delta proposed a new fidelity program based on the money spent by passengers to replace the one based on the miles flown by passengers, American did the same. Overall, we saw that some mergers could be beneficial among the four major airlines. This might be translated by major airlines that additionally proposed low-cost services, leading to the recent distinction between these and "ultra low-cost carriers" (the classical low-cost carrier as is often known), after the recent mergers. The position might be considered too dominant: if United and American were to merge (the two smallest in this top 4), they would own more than 30% of the U.S. domestic market share. Still, this exercise supports that it might be more optimal to allow for some more mergers, even though the resulting position would be quite dominant, similarly to a natural monopoly for instance. This is not observed with airlines that have low fixed costs (the low-costs airlines). There might thus be, again, an interest in studying markets for low-costs and standard airlines separately. The market for low-costs airlines could be modelled as we did, while the market for standard airlines could be modelled taking into account fixed costs, using models of entry, adaptation and exit. This distinction can be found in papers such as Ciliberto & Tamer (2009) that show that competitive effects differ between the largest, non low-cost airlines and the low-cost airlines. Low-cost airlines often rent the aircrafts, while standard airlines often buy them.

An additional improvement could be using non-linear demand functions, but much more time would have been required to do that as the methodology would have relied on iterated best responses. Coordinated effects are also worth investigating in an improved version of this paper, as only unilateral effects were considered here.

Overall, the paper suggests that the wave of deregulation then mergers might have been, and might still be, an efficient way to naturally select the "winners" of the industry, which will most likely be more strictly regulated in the future. This might have allowed to concentrate the industry which would not have been sustainable otherwise, to keep the most efficient airlines (those that survived competition) and, in the future, to regulate these survivors.

5 Appendix

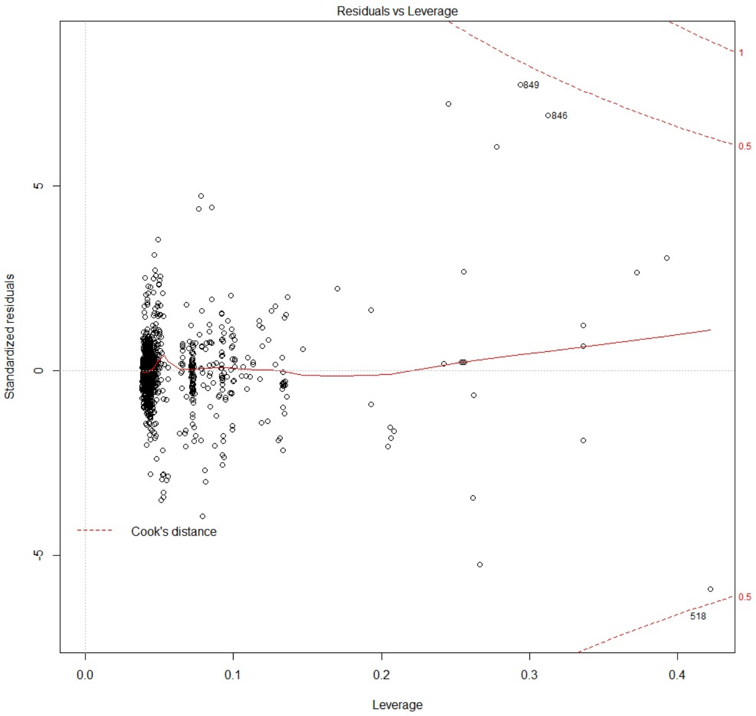

Figure 1: Residuals vs. Leverage Plot for Regression (4) of Table 2

Table 41: Mergers (1) to (5) of Table 7, Pricing instead of Quantity Setting Game

	(1)		(2)		(3)		(4)		(5)	
	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities	Prices	Quantities
WN	1.07E-13	2.09E-14	2.02E-13	4.19E-14	-1.78E-13	0	1.54E-13	2.09E-14	3.44E-13	4.19E-14
DL	-1.82E-13	0	-1.47E-13	2.07E-14	5.33E-13	-2.07E-14	3.40E-14	0	-7.15E-13	-1.04E-13
AA	1.33E-13	0	3.10E-13	1.33E-14	-6.86E-13	-5.34E-14	-2.21E-13	0	4.64E-13	5.34E-14
UA	-1.77E-13	0	-1.45E-13	-2.01E-14	-7.57E-13	-6.02E-14	-1.45E-13	-2.01E-14	4.83E-14	0
B6	5.15E-13	-1.33E-13	1.14E-12	-3.40E-13	4.83E-13	-9.70E-14	-1.27E-12	2.43E-14	1.53E-12	-4.49E-13
NK	3.81E-13	-8.51E-14	-1.48E-12	3.40E-14	-3.06E-12	-3.40E-14	-2.33E-12	1.70E-14	-1.05E-12	0
OO	8.52E-13	2.36E-13	-1.29E-12	0	8.19E-12	-1.96E-14	2.47E-12	4.91E-13	-4.01E-12	5.70E-13
S5	-3.17E-13	3.22E-14	-5.81E-13	1.61E-14	2.64E-13	4.83E-14	5.28E-14	0	-5.10E-13	0

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