Initial Estimates of the Price Effects of US Airways and American's Merger

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Abstract

I investigate the price effects of the 2014-2015 merger between US Airways and American Airlines. I use DB1B data from the Bureau of Transportation Statistics website. I consider profit series, price series between specific pairs, and overall price series among all city pairs over a given set of distance ranges. Initial evidence suggests there was no lasting price effect due to the merger.

1 Introduction

In this paper, I examine the market power consequences of the 2014-2015 merger between AMR Corporation (American) and US Airways Group, Inc. (US Airways). Following [1] and [3], I focus on the price effects of the merger. The Department of Justice (DOJ), in [6], identified a list of approximately 900 city pairs where the merger was likely to have significant effects on American's market power. I examine median price sequences in these cities. I then compare these price sequences with those of the overall market, within given distance classes. Finally, I also examine the airline profits series over the merger timeline. While profits seem to be on the rise for American, unlike other airlines, there does not appear to be a sustained increase in price over the city pairs the DOJ designated as at risk for merger consequences.

Many prospective studies have been done on the consequences of mergers in general; see, for example [7] and [4]. However, relatively few studies have been done retrospectively analyzing the actual consequences of a merger. My work contributes to our understanding of these actual consequences.

Prospective studies of mergers are useful. Since mergers are far easier to prevent than they are to undo, the antitrust agencies in the U.S. must be able to accurately estimate the consequences of a merger before it happens. Generally, mergers that increase social surplus should be allowed; those that decrease social surplus should be blocked.

At the same time, prospective analyses are not without their flaws. Predictions based on solid reason may, in fact, still produce flawed estimations of the welfare consequences of a merger. Using real merger results to compare with the performance of a priori estimations can inform economists of the accuracy of their predictions. This provides valuable feedback to antitrust agencies, who must make decisions about which cases to pursue based on these merger simulations. The more closely the simulations match real world examples, the more faith we can put in our a priori simulations.

More soberly, antitrust enforcement is not without its costs and limits. As with all publicly funded institutions, the costs and benefits of our antitrust regulating agencies should be subject to scrutiny. If it is found that the antitrust agencies are failing to stop mergers that greatly reduce consumer surplus, we may be under-investing in our antitrust agencies or giving them too little power. On the other hand, if antitrust agencies are costing us more than they are saving the public, perhaps their funding need be re-channeled into more fruitful public investments. By looking back at past unblocked mergers, we may better understand the pros and cons of our current antitrust system. This can then lead to better policy decisions around how much we should be investing in antitrust enforcement.

The rest of this paper is structured as follows. In section two, I discuss details of the airline industry relevant to my analysis. In section three, I discuss my data, its source and its summary characteristics. In section four, I discuss the results of my price-effects analysis. In section six, I state my conclusions. All figures are at the end of the paper, following the works cited.

2 Industry Background

While man first took flight in 1903, commercial air travel did not really start in the US until 1925. The 1925 Air Mail Act began major commercial airmail transportation. The 1926 Air Commerce Act established the Secretary of Commerce as the arm of the Executive Branch in charge of regulating air traffic, pilot licensing, and more. Finally, the 1938 Civil Aeronautics Act established the Civil Aeronautics Board, a board which determined airline routes and regulated prices. Initially, the Civil Aeronautics Board disallowed firms to compete through price and greatly limited entry from new firms.

For nearly 40 years, the industry progressed under strict regulatory control. It was not until 1974 that the Civil Aeronautics Board first allowed airlines to experiment with discount pricing. Subsequently, Congress passed the Airline Deregulation Act in 1978. Full deregulation of fares, entry, and exit was achieved by 1983. Since then, the commercial airline industry has been able to evolve in a competitive setting.

Intuitively, we expect an unregulated industry to be more efficient than a regulated industry. [2] and [9] both find support for this claim in the airline industry. Winston particularly emphasizes the large time span over which the efficiency gains took place. The firms and practices that were most successful in the regulated airline industry took time to adapt, and sometimes die, in the unregulated airline industry.

Since deregulation, the airline industry has undergone tens of mergers and witnessed many entries and exits. During the mid 1900s the four major carriers were TWA, Pan American (Pan Am), Eastern, and United; Pan Am was the unofficial flag carrier of the US. While several other carriers operated trans-American routes concurrently, they had much smaller market shares. These other carriers included Western, Delta and Braniff. Through the 1980s, Delta and Northwest were able to grow significantly. Pan Am initially grew, merging with an airline named National in 1980, but seems to have been unable to survive in the deregulated market; Pan Am became defunct in 1991. In the early 1990s, of all the transcontinental carriers from the days of regulation, only American, Continental, Delta, Northwest, TWA, United, and US Airways remained. Since then, TWA merged with American in 2001, Northwest merged with Delta in 2008,and Continental merged with United in 2010. With the current US Airways-American merger and retiring of the US Airways brand, only three legacy carriers remain. After a little more than three decades, we have again arrived at an industry of four major airline players dominating the US Market. These major players are Delta, American, United and Southwest.

The US Airways-American merger has resulted in a significant increase in the HHI scores of the airline industry for several US city pairs. In more than 1,000 US city pairs, the Department of Justice (DOJ) estimates the merger will increase HHI's over 1000 points. Currently, Delta, American, United and Southwest account for over 80% of the domestic scheduled passenger service market. The newly merged American is the largest airline in the world. Due to the high concentration of the industry in general, in addition to the size of the newly merged American, there is strong reason to suspect prices will rise in many city pair markets as a direct result of the merger.

Given the high likelihood of an increase in market power for the newly merged US Airways and American, the merged firm would need large efficiency gains for prices not to rise, assuming Cournot competition in the market. While on the one hand, the bankruptcy of US Airways in 2011 suggests that it may be a less efficient firm, on the other, the DOJ insisted that US Airways did not need a merger and was poised to emerge from their bankruptcy dealings as a strong competitor in the airline market.

3 The Data

I obtained my data from the US Department of Transportation's Transportation Statistics Bureau. I looked at pricing data from the first quarter of 2010 until the first quarter of 2015. I focus on city pairs singled out in the US government's original complaint. These city pairs are listed in table [6]. For profit information, I look at annual reported profits from 2001 until now. I focus on the five largest airlines over the period: US Air, American, Delta, United, and Southwest.

The following merger time-line is relevant for the data at hand. The information is taken from a Chicago Sun news report [8], as well as from the Department of Justice website.

- November 2011, US Airways files for bankruptcy.

- June 2012, US Airways and American CEOs partake in merger discussion, press reports
- February 2013, both company's boards approve an $11 billion merger
- July 2013, US Airways shareholders approve the merger
- August 2013, Department of Justice sues to block merger
- April 2014, US District of Columbia gives Final Judgment in merger case
- April 2014 - December 2015, US Airways and American consummate merger, US Airways brand retires

We may expect market power gains from the merger to occur as soon as both companies begin sharing information. The efficiency gains that come out of the merger may not occur until once the merger is fully consummated, however. By looking at pricing series for the time from 2011 to 2015, we can pinpoint exactly when prices rise in response to the market power effect, and then when they fall, in response to gains from increased efficiency.

4 Accounting Profit, Revenue and Cost Analysis

If either efficiency gains are occurring or prices are rising, profits must be increasing. Therefore, confirmation of rising profits seems to be a necessary condition for either of these effects.

The time series of reported profits for US Air, American, United, Delta, Southwest, and the aggregate industry are displayed in Figure 1. We see from these graphs that US Air and American both seem to have an upward trend to their profits since 2001, with profits at some of their highest levels over the last three years. Thus, this evidence suggests that it is not unreasonable for the firms' market power to have increased since their merger or that efficiency gains have occured.

One caveat, however, is that accounting profits are not the same as economic profits. Necessarily, our profit series is based on reported accounting profits and may not take into account changes in opportunity cost over the time period. Moreover accounting profits may be the result of gains from the firm's investment opportunities, something outside our consideration. They also may depend on debt obligations, which could be reduced simply by increased investor confidence in the new merged entity. Thus, observing increased accounting profit, as suggested by Figure 1, is not sufficient to say any market power gains or efficiency gains have been realized.

Moreover, rising profits do not appear to be unique to these two firms. While some firms, such as United and Delta, do not appear to have increasing profit over the period, the industry as a whole does have increasing profit. Thus, we cannot rule out demand shocks as a source of increasing profits over the time series.

5 Price Analysis

The ideal analysis for the price effects of this merger would require a counterfactual estimation. We would like to compare the true, observed change in prices against the change that occured in prices in a world where the merger didn't occur. Since this comparison cannot be made, we will have to suffice with comparisons between city pairs where price effects are most noticeable and those where price effects are unlikely.

Prices are inherently volatile in the airline industry. Prices change seasonally; typically prices are higher in the summer and winter than they are in the fall and spring. Prices have also been adjusting as the airline industry sheds its inefficiencies from the days of regulation [9]. To control for this, I plot the entire price series by quarter. Any seasonal effects should be visible in these series. Careful scrutiny of these series protects against potentially misleading statistical analysis of point changes.

In Figures 2 - 6, I plot median price sequences from a random selection of cities in the Department of Justice's list of cities where price-effects are likely; again the full list of cities is found in Appendices 1-13 of [6]. I chose the cities randomly to ensure they would (statistically) be most likely to represent the DOJ's entire set of more than 900 city pairs. Since the list is in order of decreasing change in HHI, I also separately considered the first 10 and the last 10 cities. As the change in HHI did not appear to produce structurally different series from the random selection, I only included the random selection in this paper.

I break the prices up by airline. I do this to gain insight on which firms might be colluding. I consider price sequences for American, US Air, Delta, United, Southwest, everyone but these firms (listed as "Other" on the graphs), and the median over the entire industry (listed as "total"). I used median prices because of the long right tails of the price distributions and the mass point at zero driving mean estimates to the right. The long right tails are likely due to mistakes in airline price entry and the zeros due to air-miles redemptions; neither of these effects are economically relevant to specific city-pair prices.

I draw the following observations from these series. While the median prices are not the same for all airlines, they appear to move together. No group of prices appears to follow a different trend. The difference in median prices from airline to airline can be accounted for by differences in plane ammenities and customer demand for individual airlines; it is not inherently significant in this analsysis. Finally, the average price path does do not appear to increase over the time period. In general it appears to remain constant, or even decrease, through the time of the merger. This holds for all cities sampled.

From these observations, it would seem that the merger could only be having price effects if these market prices fell less than they would have fallen had the merger not occurred. Thus, I turn to look at the price series for all other cities. If price series in all other cities are declining more than those in the DOJ's list, it suggests the merger did have significant price effects.

Following [3], I break the flights into 500 mile distance groups while comparing price changes. The longest domestic flight in the data is 6505 miles. Thus, I consider 14 groups over distances described by the following partition of mile classes: (6,506], (506, 1006], ... (6006,6506]. No flights are less than six miles long. In Figure 7, I compare median prices of all recorded flights in a mile class vs the median of all median prices from city pairs from the DOJ Appendices 1 through 10 by mile class. That is, I first break the data up into mile classes one through fourteen. I then find the median price per mile class over all flights. I finally find the median price over the set of median prices I had found earlier in this paper.

Time and data constraints required me to consider the median over the medians, rather than the unqualified median over DOJ city pairs. However, this should not affect the price trends in a significant way. Finally, I did not include city pairs from Appendices 12-13 of the DOJ list, as the change in HHI did not seem significant enough to warrant a noticeable price change in these markets.

The series portrayed in Figure 7 suggest prices in all cities followed a similar trend. The median path of median prices over cities likely to have price effects appears the same as the median price over all cities. It seems the merger has not yet resulted in noticeable price effects.

Though it may be useful to supplement this trend analysis with some basic statistical hypothesis tests, the results are unlikely to show anything different from what we have already concluded.

A Cournot competitions structure is implicitly assumed in [1] and [3]. Both authors found price effects in their studies. The conclusions from this paper are not out of line with those studies. Today's market may be quite different from the market at the time of those papers, both written over 20 years ago. The market could compete in a more Cournot style now. Alternatively, it could simply be that collusion is already so well entrenched in the industry that the merging of these two firms did little to any individual firm's market power.

6 Conclusion

Insofar, there do not seem to be any sustained price effects from the merger. This may change as time unfolds. The merger may simply need more time to fully consummate. Alternatively, the strongly worded complaint filed by the DOJ may have encouraged initial discreteness among the major players in the airline industry. It also may be that the competition is Bertrand and thus, as long as there are at least two firms in all the city pairs, no market power can be established. Finally, it could be that the level of collusion between US Air and American was so high before the merger that the merger had no effects on market power. Over the next few years, as the merger fully consummates, the answer will become clear.

References

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[4] Aviv Nevo. Mergers with differentiated products: the case of the ready-to-eat cereal industry, 2000.

[5] Department of Justic, US Air Plaintiff States, and American. *Final Judgement in US Air, American, United States of America, et al.* United States District Court, District of Columbia: Case no. 1:13-cv-01236, 2014.

[6] Department of Justic and Plaintiff States. *Complaint against US Air and American Merger.* United States District Court, District of Columbia: Case no. 1:13-cv-01236, 2013.

[7] Craig Peters. Evaluating the performance of merger simulation: Evidence from the u.s. airline industry. *CSIO working paper/Northwestern University, Center for the Study of Industrial Organization*, 31(0033), 2003.

[8] Bill Ruminski. Timeline: American, us airways merger. *Chicago Sun Times.*

[9] Clifford Winston. U.s. industry adjustment to economic deregulation. *Journal of Economic Perspectives*, 12(3):89–110, 1998.

A Simulation R Code

```
#######################################################
#######################################################
rm(list = ls())
profits = read.table(paste("C:/Users/Ryan/Documents/AirlineData",
                    "/airlineprofits.txt",sep=""),header = T)
revenue = read.table(paste("C:/Users/Ryan/Documents/AirlineData",
                      "/airlinerevenues.txt",sep=""),header = T)
head(profits)
head(revenue)

###########################################################
#first profits
###########################################################
xval = seq(from = 2000.25,length = nrow(profits), by = .25)
plot(xval, profits[,3])

fit = list(10)
fit[[1]] = lm(profits[,3]~xval)
col.vec = rainbow( (ncol(profits)-3) )
for(i in 4:ncol(profits)){
  fit[[(i - 2)]] = lm(profits[,i]~xval)
  lines(xval,profits[,i],col = col.vec[i])
}

#choose i value
i = input
name = names(profits)
plot(xval,profits[,i], main = name[i],xlab = 'Year',ylab = 'profits',lty = 2,type = 'l')
abline(fit[[i-2]],col = 'red')
legend(x = 'bottomright',c("data","OLS"),lty = c(2,1),lwd = c(2.5,2.5), col = c("black","red"))
for(i in 1:(ncol(profits)-2)){
   print(summary(fit[[i]]))
   print(i)
}

############################
#shortening
############################
xval.s = seq(from = 2010.25,length = nrow(profits.s), by = .25)
profits.s = profits[41:nrow(profits),]
plot(xval.s, profits.s[,3])

fit.s = list(10)
fit.s[[1]] = lm(profits.s[,3] ~xval.s)
col.vec = rainbow( (ncol(profits.s)-3) )
for(i in 4:ncol(profits.s)){
  fit.s[[(i - 2)]] = lm(profits.s[,i]~xval.s)
  lines(xval.s,profits.s[,i],col = col.vec[i])
}
```

```
col.vec
plot(xval.s,profits.s[,i])
abline(fit.s[[i-2]])

for(i in 1:(ncol(profits.s)-2)){
  print(summary(fit.s[[i]]))
}

##########################################################
#pricing data
##########################################################

prices = read.table(paste("C:/Users/Ryan/Documents/AirlineData",
                          "/DB1B2014Q1.csv",sep=""),header = T, sep = ",")
price = prices[,-ncol(prices)]
head(price)

sum((price[,13]<300)&(price[,13]<250))
condition1 = ((price[,13]<300)&(price[,13]>250))&(price[,11]<10000)&(price[,11]>0)
flight1 = price[condition1,]
plot(ecdf(flight1[,11]))
plot(density(flight1[,11]))
boxplot(flight1[,11])

  condition1.1 = condition1&(prices[,9] == "US") #us air
  condition1.2 = condition1&(prices[,9] == "AA") #American
  condition1.3 = condition1&(prices[,9] == "DL") #delta
  condition1.4 = condition1&(prices[,9] == "WN") #Southwest
  condition1.5 = condition1&(prices[,9] == "VX") #Virgin
  condition1.6 = condition1&(prices[,9] == "UA") #United

  lines(ecdf(prices[condition1.1,11]), col  = 'red')
  lines(ecdf(prices[condition1.2,11]), col  = 'blue')
  lines(ecdf(prices[condition1.3,11]), col  = 'red')
  lines(ecdf(prices[condition1.4,11]), col  = 'purple')
  lines(ecdf(prices[condition1.5,11]), col  = 'orange')
  lines(ecdf(prices[condition1.6,11]), col  = 'yellow')

  mean(prices[condition1.1,11])
  mean(prices[condition1.2,11])
  mean(prices[condition1.3,11])
  mean(prices[condition1.4,11])
  mean(prices[condition1.5,11])
  mean(prices[condition1.6,11])

mean(prices[condition1.1,11]) - sd(prices[condition1.1,11])/sqrt(length(prices[condition1.1,11]))*1.96

condition2 = ((price[,13]<350)&(price[,13]>=300))&(price[,11]<12000)&(price[,11]>0)
flight1 = price[condition2,]
```

```
plot(ecdf(flight1[,11]))
plot(density(flight1[,11]))
boxplot(flight1[,11])

condition3 = ((price[,13]<400)&(price[,13]>=300))&(price[,11]<15000)&(price[,11]>0)
flight1 = price[condition3,]
plot(ecdf(flight1[,11]))
plot(density(flight1[,11]))
boxplot(flight1[,11])

###############################################
###############################################
#looking at merger city pairs
################################################
rm(list() = ls)
#my data
mystr = list("C:/Users/Ryan/Documents/AirlineData/DB1B2014Q4.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2014Q3.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2014Q2.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2014Q1.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2013Q4.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2013Q3.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2013Q2.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2013Q1.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2012Q4.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2012Q3.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2012Q2.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2012Q1.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2011Q4.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2011Q3.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2011Q2.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2011Q1.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2010Q4.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2010Q3.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2010Q2.csv",
  "C:/Users/Ryan/Documents/AirlineData/DB1B2010Q1.csv")

citypair = read.table("C:/Users/Ryan/Documents/AirlineData/citypairs.txt",
                  header = T)

citylist = citypair[,]

cities = nrow(citylist)
alpha = .5
out = matrix(0,20,cities)
out.AA = matrix(0,20,cities)
out.US = matrix(0,20,cities)
out.OT = matrix(0,20,cities)
out.DL = matrix(0,20,cities)
```

```
out.WN = matrix(0,20,cities)  #southwest
out.UA = matrix(0,20,cities)
#cond.comp = c(T,nrow(price)) #to find which city pairs never get called
    #actually, I would need 20 of these, if I had the memory
for(i in 1:20){
  price = (read.table(mystr[[i]], header= T, sep = ","))[,c(4,7,9,11,13)]
  for (j in 1:cities) {
    cond = ((as.character(price[,1])==as.character(citylist[j,1]))&
            (as.character(price[,2])== as.character(citylist[j,2])))|
      ((as.character(price[,1])== as.character(citylist[j,2]))&
        (as.character(price[,2])== as.character(citylist[j,1])))
    out[i,j] = quantile(price[cond,4],probs = alpha)
    out.AA[i,j] = quantile(price[(cond&(price[,3] == "AA") ) ,4],probs = alpha)
    out.US[i,j] = quantile(price[(cond&(price[,3] == "US") ) ,4],probs = alpha)
    out.DL[i,j] = quantile(price[(cond&(price[,3] == "DL") ) ,4],probs = alpha)
    out.UA[i,j] = quantile(price[(cond&(price[,3] == "UA") ) ,4],probs = alpha)
    out.WN[i,j] = quantile(price[(cond&(price[,3] == "WN") ) ,4],probs = alpha)
    out.OT[i,j] = quantile(price[(cond&(price[,3] != "US")&(price[,3] != "WN")&
              (price[,3] != "UA")&(price[,3] != "AA")&
                (price[,3] != "DL")) ,4],probs = alpha)
  }
  rm(cond)
  if(i < 20) {
    rm(price)
  }
  print(i)
}

#determining list of distances
dist = rep(0,cities)
for (j in 1:cities) {
  cond = ((as.character(price[,1])==as.character(citylist[j,1]))&
          (as.character(price[,2])== as.character(citylist[j,2])))|
  ((as.character(price[,1])== as.character(citylist[j,2]))&
        (as.character(price[,2])== as.character(citylist[j,1])))
  dist[j] = price[which(cond)[1],5]
  if (j %% 50 ==0) {
    print(j)
  }
}

write(t(dist), "C:/Users/Ryan/Documents/AirlineData/distance.txt", 1)
write(out, "C:/Users/Ryan/Documents/AirlineData/out.txt", 20) #and rest
picked = sample(1:cities, 30, replace = F)
write(picked, "C:/Users/Ryan/Documents/AirlineData/picked.txt", 1)

citydist = cbind(citylist,dist)

for (w in picked) {
```

```
xval.s = seq(from = 2010.25,to = 2015, by = .25)
yval.s = seq(from = 0, to = 500, length = length(xval.s))
plot(xval.s, yval.s, main = paste("Median Price Between City Pairs ",
                    citylist[w,1], " and ", citylist[w,2], " by Carrier and Quarter",
                    sep = ""), type = 'l', lty = 2, col = "White",
                    xlab = "Quarter", ylab = "Media price"       )
lines(xval.s,out[,w], col = 'Black',lty = 1)
lines(xval.s,out.AA[,w],col = 'Blue',lty = 3)
lines(xval.s,out.US[,w],col = 'Orange',lty = 4)
lines(xval.s,out.OT[,w],col = 'Green', lty = 5)
lines(xval.s,out.DL[,w],col = 'Red', lty = 2)
lines(xval.s,out.UA[,w],col = 'brown',lty = 6)
lines(xval.s,out.WN[,w],col = 'purple', lty = 7)
}

#removing any NAs
nas = !is.na(dist)
cd.s = citydist[nas,]
max(cd.s[,3])
min(cd.s[,3])


############################################################
#looking for city groups with similar distances
############################################################
sup = seq(from = 6, to = 6506, by = 500)
length(levels(cd.s[,1]))
hist(cd.s[,3], breaks = sup)
#note that there are none in the 5500-6000 range

medpric = matrix(0,20,(length(sup)-1))
ctlevels = rep(0,13)
for(i in 1:19){
  price = (read.table(mystr[[i]], header= T, sep = ","))[,c(4,7,9,11,13)]


  for (j in 1:(length(sup)-1) ) {
    cond= (price[,5]>sup[j])&(price[,5]<sup[(j+1)])
    #medpric[i,j] = quantile(price[cond,4],prob = alpha)
    if (i ==20) {
    ctlevels[j] = length(levels(price[cond,1]))
    }
  }
  rm(cond)
  if(i < 20) {
    rm(price)
  }
  print(i)
}
```

```
write(t(medpric), "C:/Users/Ryan/Documents/AirlineData/medpric.txt", 20)
length(levels(price[cond,1]))

#median change within group for our set of travels
#total, AA, US, Delta,United
out.big = array(0,c(20,13,5))

for(i in 1:20) {
  for (j in 1:(length(sup)-1) ) {
    cond= (cd.s[,3]>sup[j])&(cd.s[,3]<sup[(j+1)])
    out.big[i,j,1] = quantile(out[i,cond],alpha,na.rm = T)
    out.big[i,j,2] = quantile(out.AA[i,cond],alpha,na.rm = T)
    out.big[i,j,3] = quantile(out.US[i,cond],alpha,na.rm = T)
    out.big[i,j,4] = quantile(out.DL[i,cond],alpha,na.rm = T)
    out.big[i,j,5] = quantile(out.UA[i,cond],alpha,na.rm = T)
  } #close j
} #close i

bigbind = rbind(out.big[,,1],out.big[,,2],out.big[,,3],out.big[,,4],out.big[,,5])
write(t(bigbind),"C:/Users/Ryan/Documents/AirlineData/outbig.txt",13)

####################################################
#plotting price sequences
####################################################
#choosing input w
w = input
yval.s = seq(from = 0, to = 500, length = length(xval.s))
plot(xval.s, yval.s, main = paste("Median Price for City Pairs between ",
                        sup[w], " and ", sup[(w+1)], " Miles Apart",
                        sep = ""), type = 'l', lty = 2, col = "White",
     xlab = "Quarter", ylab = "Median price"      )
lines(xval.s,out.big[,w,1], col = 'Black',lty = 1)
lines(xval.s,out.big[,w,2],col = 'Blue',lty = 3)
lines(xval.s,out.big[,w,3],col = 'Orange',lty = 4)
lines(xval.s,out.big[,w,4],col = 'red', lty = 5)
lines(xval.s,out.big[,w,5],col = 'brown', lty = 2)
lines(xval.s,medpric[,w],col = 'green',lty = 6)
legend(x = "bottom",c("Total in Suspect","AA in Suspect","US in Suspect",
          "Delta in Suspect","United in Suspect", "Avg for all"),lty = c(1,3,4,5,2,6),
      col = c("black","blue","orange","red","brown","green" ))
```

Figure 1

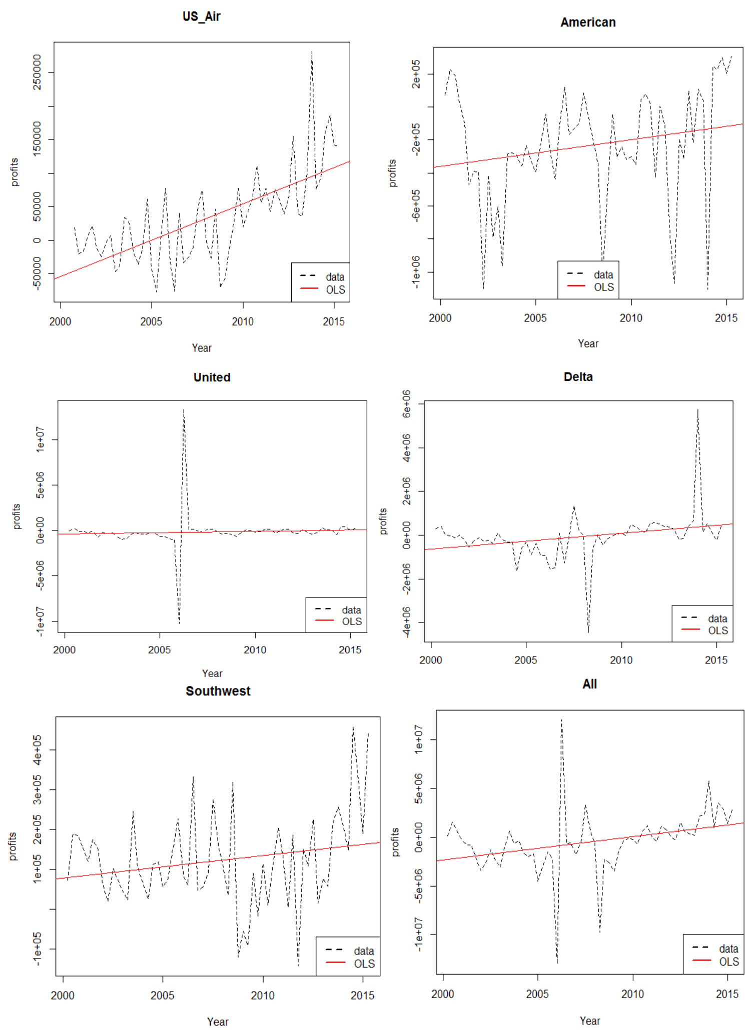

Figure 1: Above, we have the profits of various airline companies from the first quarter of 2000 to the first quarter of 2015

Figure 2

Figure 2: Above, we have a sequence of median prices by year between the given cities. I have broken down prices by airline. There not appear to be any sustained jumps in price. If anything the prices seem to decline.

Figure 3

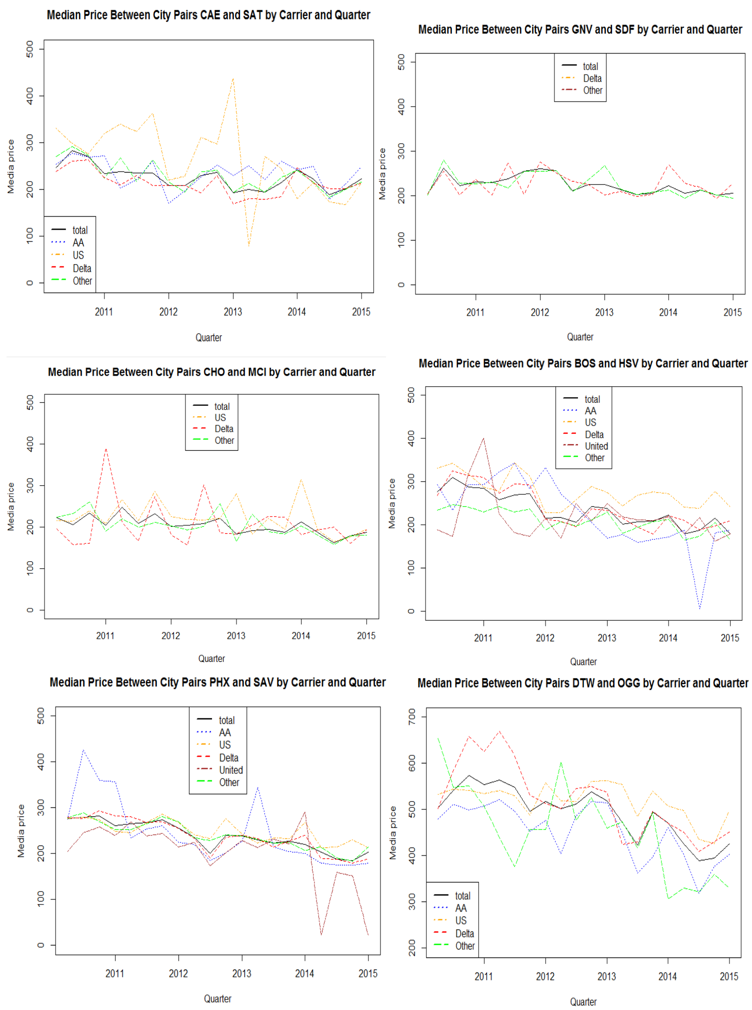

Figure 3: More median price series.

Figure 4

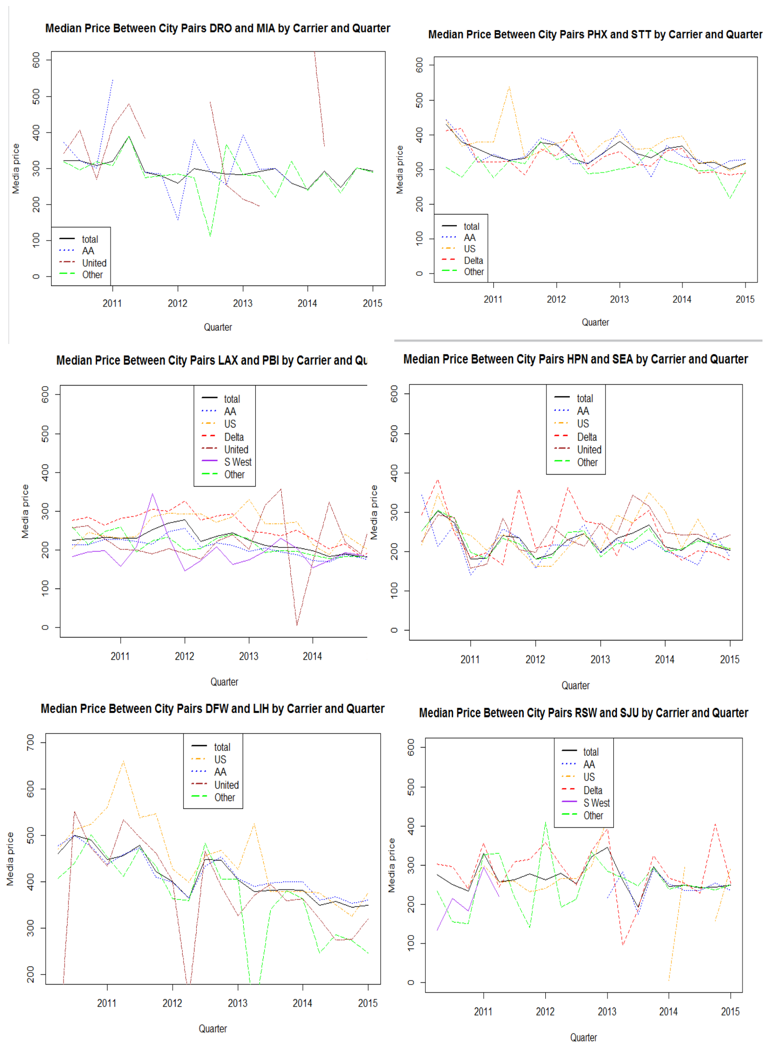

Figure 4: More median price series.

Figure 5

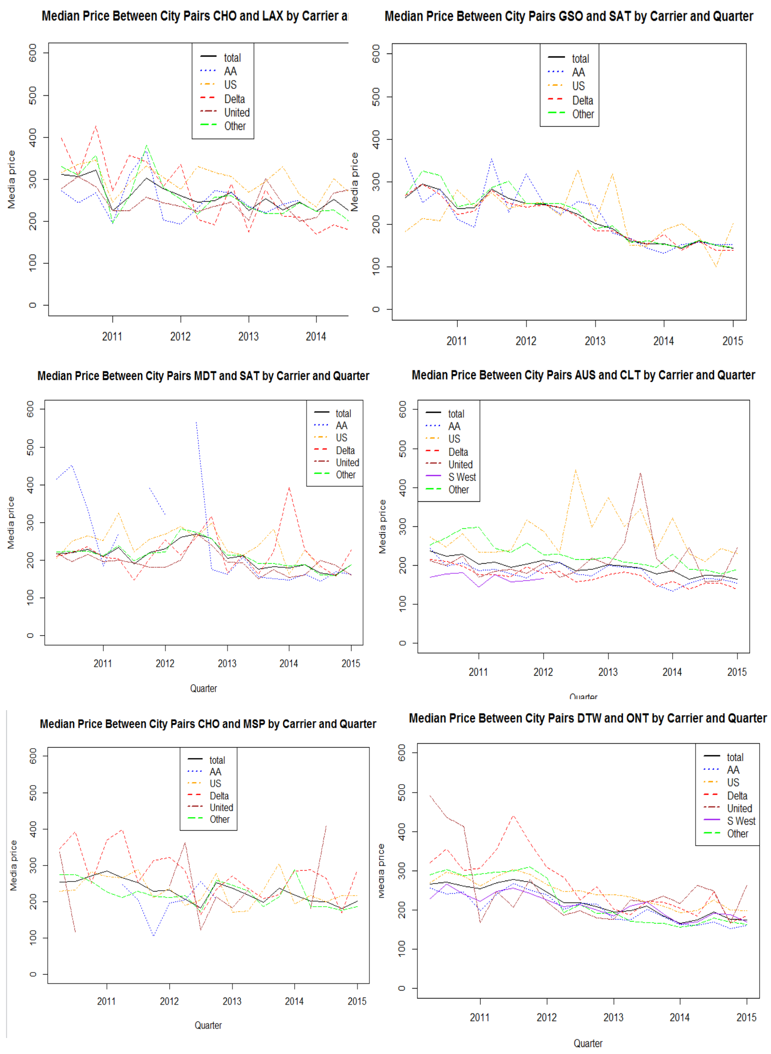

Figure 5: More median price series.

Figure 6

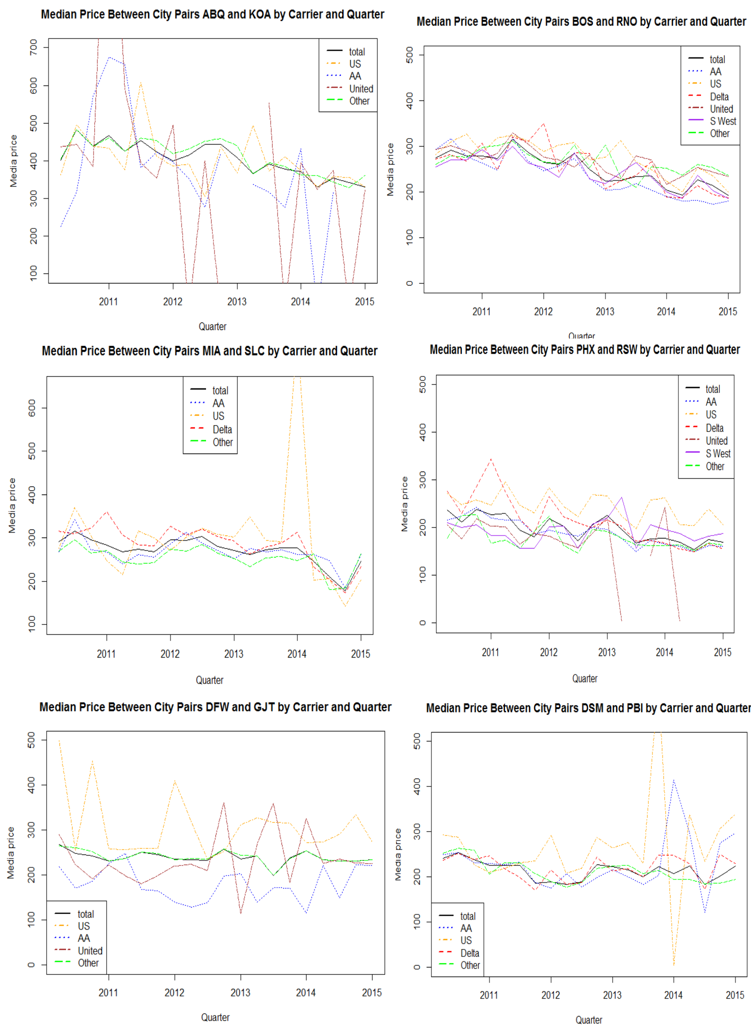

Figure 6: More median price series.

Figure 7

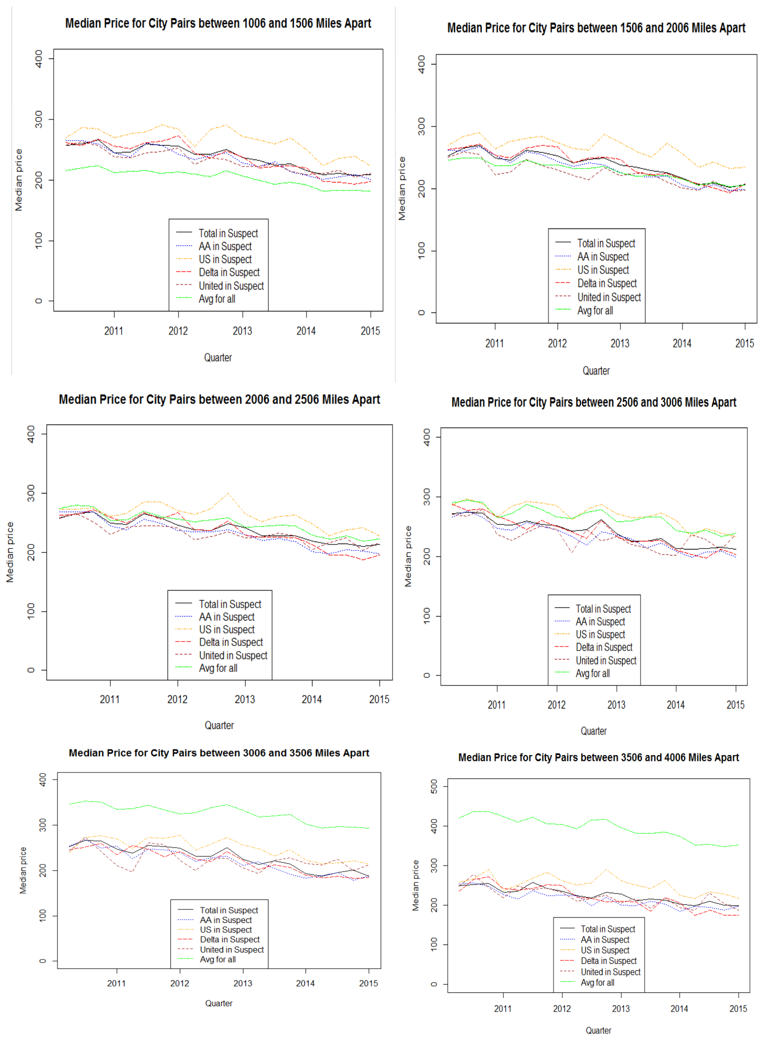

Figure 7: Median price series for all cities in given distance class vs median of median prices for all prices in DOJ city pairs list from [5] Appendices 1-10, for a given distance class.