Empirical Analysis of Firm Behavior PS1

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Question 1

The variable `market` is already defined in the dataset as an OD in a year. Grouping by `market`, I calculate `market_value` as the sum of products `passengers` times `price`. I also find the `total_passengers` in a market. Then, grouping by `carrier` and `market`, I calculate `market_share_passengers` by finding the `passengers` per `carrier` in the `market` and then dividing by `total_passengers`. Alternatively, I also include `market_share_sales` for completeness.

Grouping by year and `merging_markets`, which I define as markets in which in 2016 both AA and UA were operating, I show mean and standard deviation of market shares and HHI.

Discussion

From 2016 to 2017, mean market shares in non-merging markets fall from 24.4 to 22.7; median rises as well, from 8.9 to 9.3.

In the merging markets, mean rises from 15.3 to 18.1 over the 2016-2017 period; and median from 4.8 to 7.4. Mean market shares in non-merging markets are always greater than in the merging markets, and median is always higher as well.

Question 2: How did the merger affect average HHI? What was the change across similar markets?

Considering all markets: HHI falls in non-merging markets from a mean of 5355 to 5066; in merging markets, there is a rise from 4161 to 4482. However, HHI continues to be higher in non-merged markets than in the merged markets.

Now let's try to filter for markets that are more similar to the markets in which United operates.

In markets where United is present, we have:

year	merging_markets	mean_market_share	mean_hhi

year	merging_markets	mean_market_share	mean_hhi
2016	no	22.7	5222
2017	no	27.9	5106
2018	no	28.7	5065
2016	yes	24.1	4461
2017	yes	29.7	4792
2018	yes	29.2	4706

Across all markets, the changes are:

year	merging_markets	mean_market_share	mean_hhi
2016	no	24.4	5355
2017	no	22.7	5066
2018	no	22.9	5030
2016	yes	15.3	4162
2017	yes	18.1	4483
2018	yes	18.5	4412

The average `total_passengers` and the average `market_value` for markets with UA presence are 250 and 75000, approximately. To select firms that are in similar markets (without filtering for precisely the same markets as United), I choose cutoffs of `total_passengers > 200` OR `market_value > 75000` which gives:

year	merging_markets	mean_market_share	mean_price	mean_hhi
2016	no	22.34	271.42	5137
2017	no	21.35	288.01	4945
2018	no	22.35	280.69	4973
2016	yes	14.75	301.34	4034
2017	yes	17.5	318.92	4570
2018	yes	18.22	310.73	4452

Notice that price *trends* are almost exactly the same in merging vs non-merging markets; from 2016 to 2017 price increases by $\approx \$17$, from 2017 to 2018 it decreases by $\approx \$8$.

Question 3

I use the same control group as defined before; non-merging markets with similar characteristics. In this case I filter for markets that have between 200 and 400 total passengers *or* a market value between 50,000 and 100,000. These filters leave about 4500 merging markets and 5600 non-merging markets to compare. I run a simple DiD regression, with fixed effects at the carrier level:

```
price ~ merged + merging_markets + merged * merging_markets
```

where `merged` indicates that the merger has occurred at all ($year \geq 2017$), and `merging_markets` indicates that the merger took place in the particular market.

The results give that:

Coefficients	Estimate	Std. Error	P value
merged	2.72	5.83	0.641
merging_markets	3.34	6.65	0.610
merged*merging_markets	14.58	8.05	**0.070**

The only statistically significant coefficient is the DiD coefficient, which is significant at the 10% level. For the selected markets, price is on average $14.58 higher in the merging markets after the merger takes place than it is in the non-merging markets. Notably, none of these coefficients are robust to large changes in the chosen filter criteria. The DiD coefficient is, however, always positive and significant at the 10% level regardless of any reasonable market filter criteria.

Question 4

Without filtering as before, there seems to be a near-zero effect of this merger on `MHHI`; it remains within a few points of 10,000 in every market. HHI and price also do not significantly change.

year	m_m	owner_merged	price	hhi	mhhi	delta_mhhi
2017	no	no	245.72	5597	9994	4398
2018	no	yes	247.16	5622	9995	4373
2017	yes	no	341.48	4623	9993	5370

year	m_m	owner_merged	price	hhi	mhhi	delta_mhhi
2018	yes	yes	343.31	4536	9994	5458

Note that *m_m* is short for merging markets. Now using the same filters as in Question 3, the table becomes:

year	m_m	owner_merged	price	hhi	mhhi	delta_mhhi
2017	no	no	256.91	5646	9995	4348
2018	no	yes	245.80	5705	9996	4291
2017	yes	no	356.88	4859	9993	5134
2018	yes	yes	355.86	4642	9994	5352

and prices and mean HHI have slightly decreased, though it is unclear if this is significant. Notably, `delta_mhhi` only increased in those markets in which the UA merger took place.

Question 5

Without FE

	Dependent variable:
	log(price)
hhi	0.016***
	(0.001)
delta_mhhi	0.016***
	(0.001)
online	-0.574***
	(0.016)
roundtrip	0.462***
	(0.013)
year2017	0.033**
	(0.016)
year2018	0.011

	(0.015)
Constant	-155.785***
	(9.684)
Observations	21,882
R^2	0.135
Adjusted R^2	0.135
Residual Std. Error	0.924 (df = 21875)
Note:	*p<0.1; **p<0.05; ***p<0.01

With FE

	Dependent variable:
	log(price)
hhi	0.002
	(0.002)
delta_mhhi	0.002
	(0.002)
online	-0.069***
	(0.017)
roundtrip	0.381***
	(0.017)
year2017	0.024*
	(0.014)
year2018	0.027**
	(0.013)
Observations	21,882
R^2	0.550

Adjusted R^2	0.500
Residual Std. Error	0.702 (df = 19713)
Note:	*p<0.1; **p<0.05; ***p<0.01

Discussion of regression results

In the first regression without including fixed effects, `hhi` and `delta_mhhi` are positive and significant, as would be expected; greater market power should mean a greater ability to command higher prices. The coefficients are nearly equal, around 0.161 each. However I believe this is more of an artifact of the construction of $\Delta MHHI$. It is equal to $MHHI - HHI$ and since in this dataset the provided $MHHI$ is almost always 10,000, every increase in HHI results in the equivalent decrease in $\Delta MHHI$ (the mean $MHHI$ of the data is 9994 and the minimum is 9960).

These coefficients are thus not very informative at all, and the coefficient for HHI will be underestimated. Coeffients for online and roundtrip are as we might anticipate; tickets purchased online are at a lower price, and roundtrip tickets at a higher price. Presumably flyers who purchase tickets online have more information about other prices and are more price sensitive; those that call or purchase a ticket in person will have a higher willingness to pay. And, roundtrip routes should cost more than non-roundtrip routes. (there is no given definition of these variables, so my interpretation might be mistaken).

Prices are higher in 2017 as compared to 2016, but prices in 2017 are not clearly different from prices in 2018.

For the fixed effects regression, the results change a bit. $\Delta MHHI$ is as uninformative as before and we should ignore the coefficients for it and for HHI (rather, it would be better to discard $\Delta MHHI$ from the regression but I include as required).

But, after including carrier by OD fixed effects, all coefficients are much lower. Now coefficients for year2017 and year2018 are both significant at the 10% level and positive, but still unclear clear if prices are higher in 2018 than in 2017.

Question 6

I propose to drop HHI and use only $\Delta MHHI$ for the reasons discussed in previous questions. Then to run the regression of $log(price)$ on $\Delta MHHI$, $online$, $roundtrip$

and $owner\_merged$ with carrier by OD fixed effects, using only years 2017 and 2018.

```
df %>%
    felm(formula = log(price) ~ delta_mhhi + online + roundtrip +
owner_merged | carrier + OD)
```

where `owner_merged = "yes"` if `owner2 > 25` and `year == 2018` are both true.

There is the following summary, including year 2016 which we know was before the UA merger took place.

owner_merged	year	mean(price)	mean(owner2)	mean(hhi)	mean(delta
no	2016	286.50	15.87	4779	5216
no	2017	298.18	15.89	4863	5131
yes	2018	291.81	35.79	4822	5173

$\Delta MHHI$ actually slightly decreases, though not significantly, and mean price fell by about $8. A price drops can be explained by this increase in ownership: as joint ownership increases, there could be more product market collaborations (Park & Seo 2019). Additionally, the power implied by joint ownership depends what is meant by "control" shares — how much control do these owners actually have, and over which management decisions?

Maybe it could be the case that joint ownership simply encourages efficiencies and cooperation among carriers in such a way that costs can be reduced.