Airline Mergers and Product Quality: An Empirical Analysis of a 2002 Case Study from Japan

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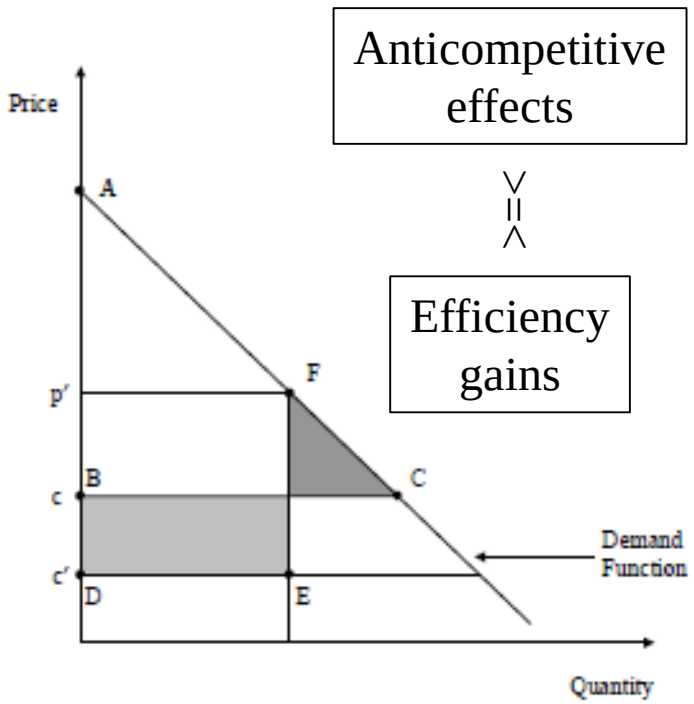
Motivation

- Conducts ex-post evaluation of a horizontal merger case taken place between airline companies
  - pre-merger shares of the merged parties dominating half the market.

- Through a retrospective analysis of a particular merger case taken from Japan, this paper attempts to present a theoretical and econometrics framework that would hopefully be of some practical assistance to a competition authority in evaluating a merger case.

Economics of Horizontal Merger

Williamson's tradeoff



This paper contains three new extensions;

1. Assess efficiency gains in a context of the product differentiated market
2. Allow product characteristics endogenous, and evaluate the welfare consequence of a horizontal merger
3. Study the effectiveness of merger remedies

Literature on Horizontal Merger: Structural Estimation

- This paper employs an structural estimation approach to examine the airline industry.
  - Berry (1990); Berry, Carnall, and Spiller (1996); Berry and Jia (2010); Peters (2006)
- Standard merger analysis typically study price effects only, and ignore changes in product characteristics.
  - Fan (2015, AER) on US newspapers; Richard (2003) on airlines at O'Hare
  - DID on airlines; Prince and Simon (2015) examines the merger effect upon on-time performance, and Chen and Gayle (2013) on internalizing competitive externalities.
  - This paper particularly focuses on flight frequency (following Morrison and Whiston, 1995; Brueckner and Luo, 2014), and studies the effect of endogenous assumption of product characteristics.
- Efficiency gains from horizontal mergers
  - DID: Ashenfelter et al (2015)
  - This paper structurally estimates and finds efficiency gains not trivial.
- Merger Remedies
  - Leveque and Shelanski (2003); Davies and Lyons (2007)
  - Few empirical work has done to assess remedies approved by CA.

Conclusion

- Allowing for endogeneity in product characteristics matters in the outcomes of merger evaluation.
  - In our application, the exogenous assumption overestimates the consumer welfare, particularly for less populated market.

- Efficiency gains from the merger are found not trivial. They are strongly observed in marginal costs per flight, relative to marginal costs per passenger.

- The structural remedy of slot allocation improved welfare, but it did not fully correct for the anticompetitive effect of the merger.

Background of the Case

- The JAL-JAS announced its intent of the merger in Nov 2011, two months after the 9.11.

- JAL (25%) and JAS (24%) planned to create a holding company to become the parent of the two.
  - The major competitor was ANA (48%).
  - The remaining 3% are regional carriers, a set of miniscule players.
- The competition authority concerned that the merger was likely to be a substantial restraint of competition in the domestic air passenger market
  - The merging party proposed remedial measures.
  1. Behavioral: the merging party announced to set the pre-merger price level as the price ceiling for the post-merger period (it failed to work)
  2. Structural: the party agreed to release 9 slots at the most congested airport, and be assigned to new entrants.
- The JFTC approved the proposed merger with the remedies.

Outline of the paper

1. DID on merger outcomes
2. Structural model and estimates
3. Discuss merger effects by use of counterfactual simulations
4. Compare estimates from exogenous vs. endogenous characteristics
5. Discuss the effectiveness of remedial measures

DID on Market outcomes

	Prices		Flight Frequency		Number of Passengers	
JJ * post	-0.01**	-0.013**	0.285***	0.082***	0.385***	0.185***
	(0.004)	(0.005)	(0.016)	(0.021)	(0.020)	(0.027)
JJ * post * MTM		0.051***		0.578***		0.966***
		(0.012)		(0.048)		(0.062)
JJ * post * MTO		-0.004		0.287***		0.246***
		(0.008)		(0.033)		(0.042)
R-squared	0.97	0.97	0.93	0.94	0.96	0.96
Number of obs.	5329		5329		5329	

- The merger decreased prices and increased flight frequency (efficiency gains), but increased prices on the merger to monopoly market (anticompetitive effects).
- Aircraft characteristics along with routes did not change much before and after the merger. Entry/exit of airlines and network was negligible during the period.
  - Among 274 routes and 8 airlines; 209 monopoly, 32 oligopoly; 6 merger-to-monopoly; 27 merger-to-oligopoly

Structural model and estimates

Structural Model

- The model consists of demand and supply (mc) of the domestic air market.

- The procedure consists of two stages;

  Stage 1: Estimate demand and mc, and recover primitive parameters from the data.

  Stage 2: Use the estimates, and simulate the counterfactual scenarios, in which no merger took place; and merger w/o the remedies took place.

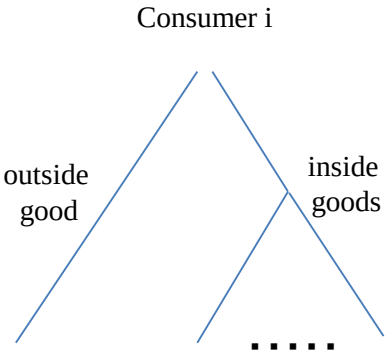
Caveats

- Ticket-level information nor flight-level information are unobservable.
- Our data are aggregate characteristics of airline flights within a market (route) by quarter.
  - We thus include ξ to capture these unobserved quality.

- A market is defined as a round trip between two endpoint airports with a departure date within a specific quater.

Demand Model

- Consumer i chooses an airline j on route m.
- Standard two-stage nested logit model:



$$\ln(s_{jmt}) - \ln(s_{0mt}) = \alpha p_{jmt} + \beta f_{jmt}^{\rho} + \mathbf{x}'_{jmt}\gamma + \sigma \ln(s_{jmt|gt}) + \xi_{jmt}.$$

Endogenous variables: p_{jrt}, f_{jrt} , $\bar{s}_{jrt}$

IVs: aircraft characteristics, fuel price, airport charges

Airline's Decision Making

A multiple-product oligopolistic player:

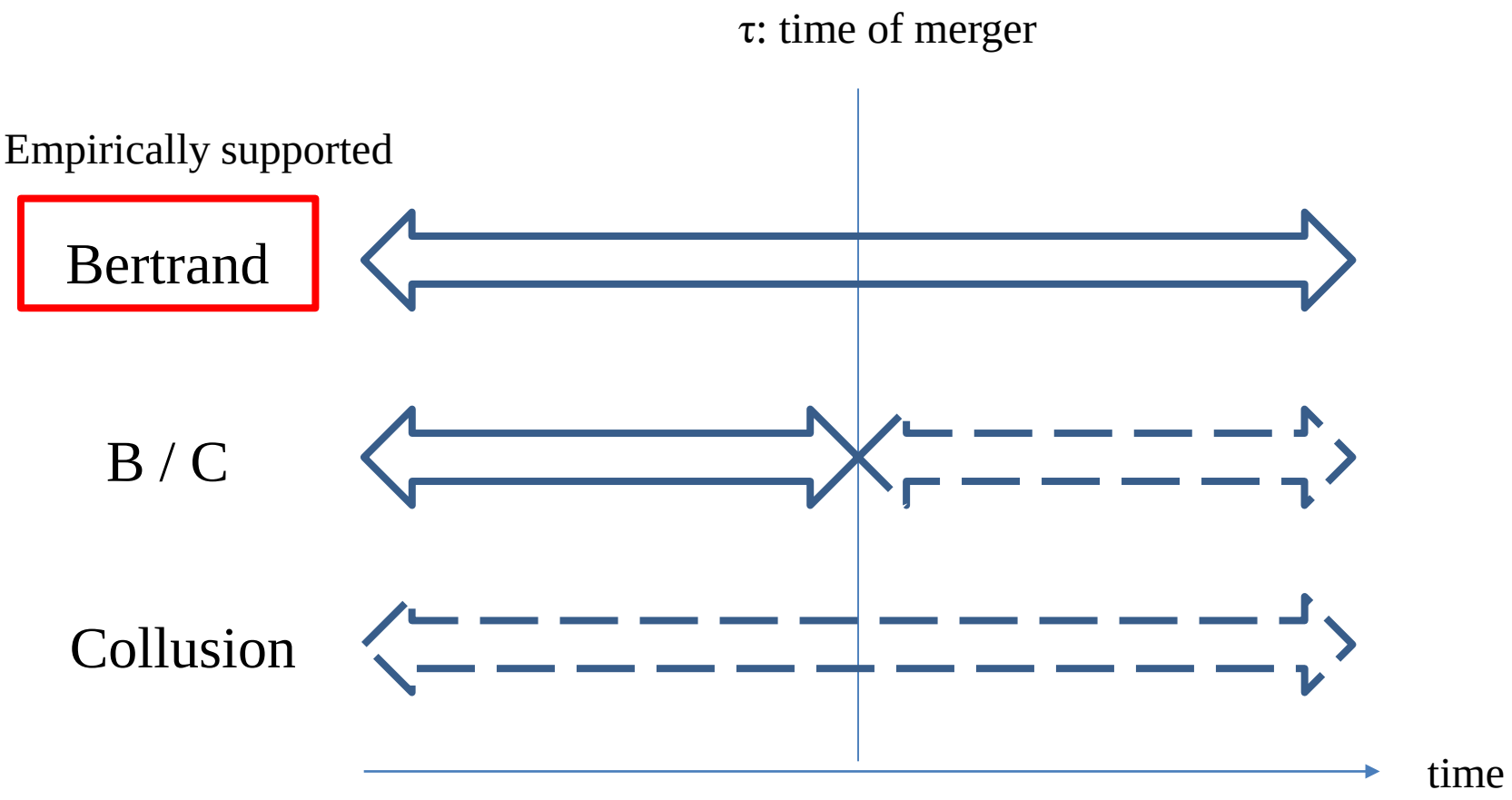
$$\max_{\{p_{jmt}, f_{jmt}\}} \sum_{s \in F_l} \left[(p_{smt} - mc^q_{smt}) \cdot q_{smt}(\mathbf{p}_{mt}, \mathbf{f}_{mt}) - mc^f_{smt} \cdot f_{smt} \right].$$

FONC:

$$\mathbf{s} + D^{\tau} \cdot B^p(\mathbf{p}, \mathbf{f})(\mathbf{p} - \mathbf{MC}^q) = \mathbf{0},$$

$$D^{\tau} \cdot B^f(\mathbf{p}, \mathbf{f})(\mathbf{p} - \mathbf{MC}^q) = \mathbf{MC}^f.$$

D^{τ} : modes of competition



Summarizing Demand Estimates

- Demand is more price elastic under 2SLS (-1.85)
- Demand increases with flight frequency at a diminishing scale.
- Estimating only with the pre-merger data also generates similar estimates.

Marginal Cost Estimates

$$\ln\left(mc^x_{jmt} + apc^x_{jmt}\right) = b^x_W \ln\left(w^x_{jmt}\right) + b^x_N \ln\left(nroute_{jmt}\right) + e^x_{jmt}.$$

Airport charges and
Other taxes

#Routes available at endpoint airports;
A proxy for economies of scale

- Estimation is done by use of demand estimates and FONCs.
- Efficiency gains from the merger are found not trivial. They are strongly observed in marginal costs per flight, relative to marginal costs per passenger.

Counterfactuals

- Counterfactual scenario w/o the merger
  - No efficiency occurred under this scenario
  - The merged parties (JAL and JAS) would have independently operated in the absence of the merger.
- We assess the merger effect on market outcomes and economic welfare.

Summarizing Simulation Results

- Overall, the merger improved social and consumer welfare, because of efficiency gains.
  - w/o efficiency, this merger case would have likely been detrimental to the society.
- Allowing for endogeneity in flight frequency reveals the extent to which competitive externalities is internalized.
- Look into details by market structure, the merger-to-monopoly markets are the one that reduce welfare.
- Reallocating slots to new entrants did not resurrect competition for the MTM, b/c none wished to enter.

Conclusion

1. Allowing for endogenous product characteristic matters in merger outcome.
   - In our application, the exogenous assumption overestimates the consumer welfare, particularly for less populated market.

2. Efficiency gains from the merger are found not trivial. They are strongly observed in marginal costs per flight, relative to marginal costs per passenger.

3. The structural remedies on slot allocation worked, but it did not correct the anticompetitive effect of the merger.

The approach could be extended to apply to:

- airline alliances
- impacts on international flights

Thank you for your attention

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REFERENCE FIGURES AND TABLES

Aircraft Characteristics

Variables	JAL-JAS			Non-merging firms		
	Engine Compression Ratio	Seats per flight	Operating weight	Engine Compression Ratio	Seats per flight	Operating weight
(Post-merger dummy)	0.133	-13.027	-2.541	-0.673	-7.434	-4.414
* (JAL-JAS-ANA routes dummy)	[1.465]	[20.672]	[6.550]	[1.563]	[23.537]	[7.796]
(Post-merger dummy)	1.428	47.369	13.918			
* (JAL-JAS routes dummy)	[2.661]	[37.721]	[11.952]			
Other variables: Post-merger dummy, JAL-JAS-ANA routes dummy, JAL-JAS routes dummy, etc.						
Observations	3284	3434	3434	2711	2779	2779
R^2	0.25	0.35	0.37	0.05	0.38	0.39

- Aircraft characteristics along with routes did not change much before and after the merger. Entry/exit was negligible.
- make frequency endogenous, holding the other characteristics at the actual levels.

Demand Estimates

	Whole Study period		Pre-merger period
	OLS	2SLS	2SLS
	(4-1)	(4-2)	(4-3)
α	-0.007 **	-0.082 ***	-0.089 ***
	(0.003)	(0.007)	(0.011)
β	-10.76 ***	-3.56 ***	-2.32 ***
	(1.78)	(0.64)	(0.37)
ρ	-0.10 ***	-0.30 ***	-0.68 ***
	(0.02)	(0.09)	(0.17)
σ	0.37 ***	0.08 ***[a]	0.23 ***[a]
	(0.02)	(0.12)	(0.20)
First-stage F -statistics (d.f.)		129.2 *** (9, 5656)	47.6 ** (8, 2164)
Chi -squared statistics (d.f.)		12.76 ** (6)	2.27 (5)
Own price elasticities	-0.17 ***	-1.85 ***	-2.13 ***
	(0.05)	(0.52)	(0.63)
Elasticities w.r.t flight frequency	1.12 ***	0.88 ***	1.19 **
	(0.16)	(0.20)	(0.60)

Marginal Cost Estimates

$$\ln\left(mc^x_{jmt} + apc^x_{jmt}\right) = b^x_W \ln\left(w^x_{jmt}\right) + b^x_N \ln\left(nroute_{jmt}\right) + e^x_{jmt}.$$

Airport charges and
Other taxes

#Routes available at endpoint airports;
A proxy for economies of scale

		Pre-merger period		Post-merger period	
nroutes	Number of Routes at endpoint airports	24.3	10.2	26.7	11.2
	JAL-JAS	21.2	8.5	28.3	10.9
	Non-merging firms	28.0	10.8	25.0	11.4

Marginal costs estimates

	6-1		6-2		6-3	
	MC^q	MC^f	MC^q	MC^f	MC^q	MC^f
nroute	-0.103***	-0.141***			-0.113***	-0.153***
	(0.025)	(0.025)			(0.031)	(0.031)
seat	-0.096	0.403***	-0.096	0.393***	-0.096	0.405***
	(0.066)	(0.071)	(0.066)	(0.072)	(0.066)	(0.071)
ow	0.042	-0.02	0.042	-0.014	0.042	-0.021
	(0.057)	(0.061)	(0.057)	(0.062)	(0.057)	(0.061)
cr	0.047	-0.034	0.052	-0.024	0.048	-0.033
	(0.032)	(0.034)	(0.032)	(0.034])	(0.032)	(0.034)
JJ * post			-0.045*	-0.067***	0.018	0.018
			(0.024)	(0.023)	(0.030)	(0.029)
ρ	0.44***	0.23***	0.44***	0.24***	0.44***	0.23***
	(0.011)	(0.014)	(0.011)	(0.014)	(0.011)	(0.014)
Efficiency gains from the merger	-3.2%	-4.5%	-4.5%	-6.7%	-13.5%	-14.7%

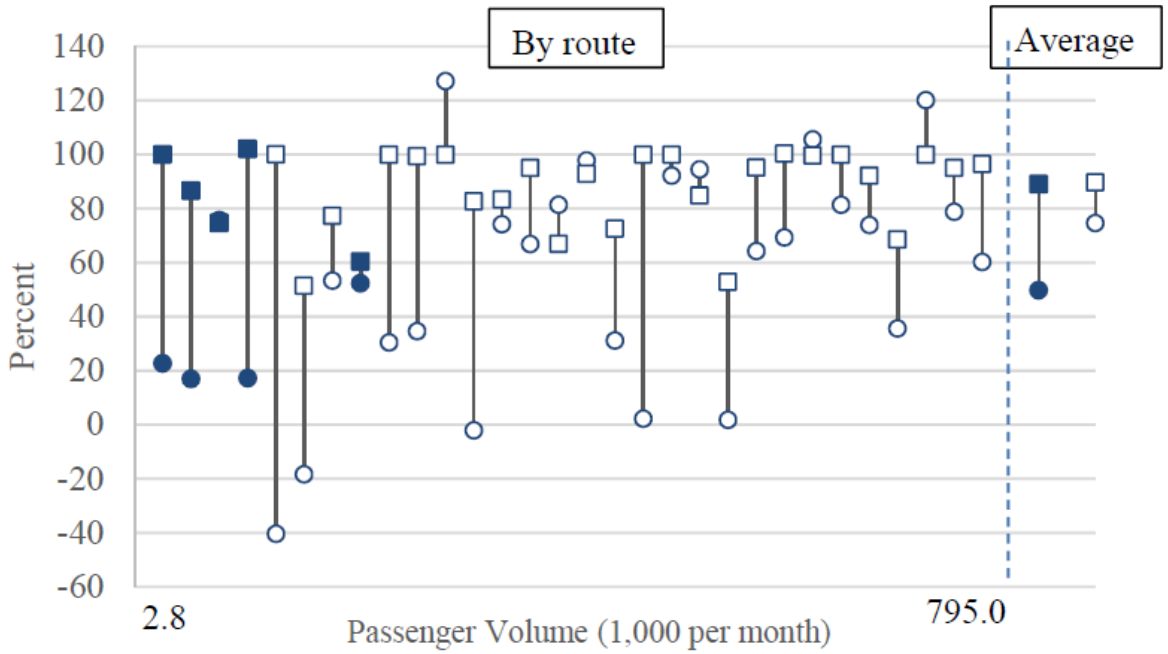
Merger effects on Market outcomes

	JAG		Non-merged parties	
	Avg	Std	Avg	Std
Prices				
All routes	-1.7%***	(0.2)	-0.03%***	(0.01)
Merger-to-monopoly	1.6%***	(0.3)		
Merger-to-duopoly	-1.7%**	(0.7)	0.1%***	(0.03)
Other routes	-1.9%***	(0.03)	-0.1%***	(0.004)
Flight frequency				
All routes	36.3%***	(0.04)	-0.2%***	(0.04)
Merger-to-monopoly	49.7%***	(0.9)		
Merger-to-duopoly	75.2%***	(0.3)	0.3%**	(0.1)
Other routes	22.7%***	(0.03)	-0.3%***	(0.04)
Passenger volume				
All routes	20.7%***	(0.04)	-0.2%**	(0.1)
Merger-to-monopoly	-7.8%**	(0.6)		
Merger-to-duopoly	0.4%	(0.1)	0.6%***	(0.2)
Other routes	29.0%***	(0.05)	-0.4%***	(0.05)
Profits	44.6%***	(1.4)	-0.3%	(0.4)

	Market Outcomes	
Consumer surplus	3.2%***	(0.9)
Social Surplus	5.8%***	(0.9)

Merger effects on flight frequency

Merger to monopoly (●(end), ■(exg)) and merger to duopoly (○□)



- Flight frequency is under endog assumption is generally lower than that under exog assumption.
- The difference tends to be larger on the merger-to-monopoly route.

Welfare impacts of merger

- Efficiency gains from the merger matter in the market outcomes.
- Competitive externalities are internalized most at the merger-to-monopoly market.
- However, the MTM is not a major presence in the overall domestic air market.

	Endogenous frequency		Exogenous frequency
	w/ Efficiency gains (9-1)	w/o Efficiency gains (9-2)	(9-3)
Consumer Welfare			
Total	3.2%*** (2.9)	-3.5%*** (2.4)	3.0%*** (1.7)
Merger-to-monopoly	-1.7% (13.5)	-16.4%*** (10.2)	16.7%*** (11.6)
Merger-to-duopoly	1.2% (4.1)	-5.8%*** (3.4)	3.1%*** (2.6)
The others	7.4%*** (0.5)	1.0%*** (0.2)	2.8%*** (0.3)
Producer Welfare			
Total	17.0%*** (3.9)	5.7%*** (3.2)	18.3%*** (4.2)
JAL-JAS	44.6%*** (13.6)	12.0%*** (9.9)	49.3%*** (13.9)
Non-merged firms	-0.3% (1.2)	1.9%*** (1.1)	-0.5% * (0.8)
Social Welfare	5.8%*** (3.0)	-1.9%** (2.5)	5.8%*** (2.0)

Impact of structural remedies

- Slot reallocation is made on profitable market, where new entrants are profit-motivated.
- Therefore, while it did improve welfare, the MTM remains intact.

	Merger effects (Copied from (9-1) in Table 9)	Merger Scenario (w/o slot reallocation)
Consumer Welfare		
Total	3.2% ***	2.8% **
Merger-to-monopoly	-1.7%	-1.7%
Merger-to-duopoly	1.2%	1.1%
The others	7.5% ***	6.4% ***
Producer Welfare		
Total	17.0% ***	16.9% ***
JAL-JAS	44.6% ***	44.9% ***
Non-merged firms	-0.3%	-0.7% *
Social Welfafe	5.8% ***	5.4% ***