

VI Semana da Qualidade da Informação do Transporte Aéreo

Painel 1: Simpósio de Economia do Transporte Aéreo (SETA 2018)

Capacidade de recuperação de malha aérea e os efeitos da padronização de frota

Rodolfo R. Narcizo
Alessandro V. M. Oliveira



Atrasos e cancelamentos

AIRLINES

AIRPORTS & AVIATION

GLOBAL

Flight disruption costs aviation industry US\$60 billion annually

(Greenwood, 2016)

By Gemma

AVIAÇÃO

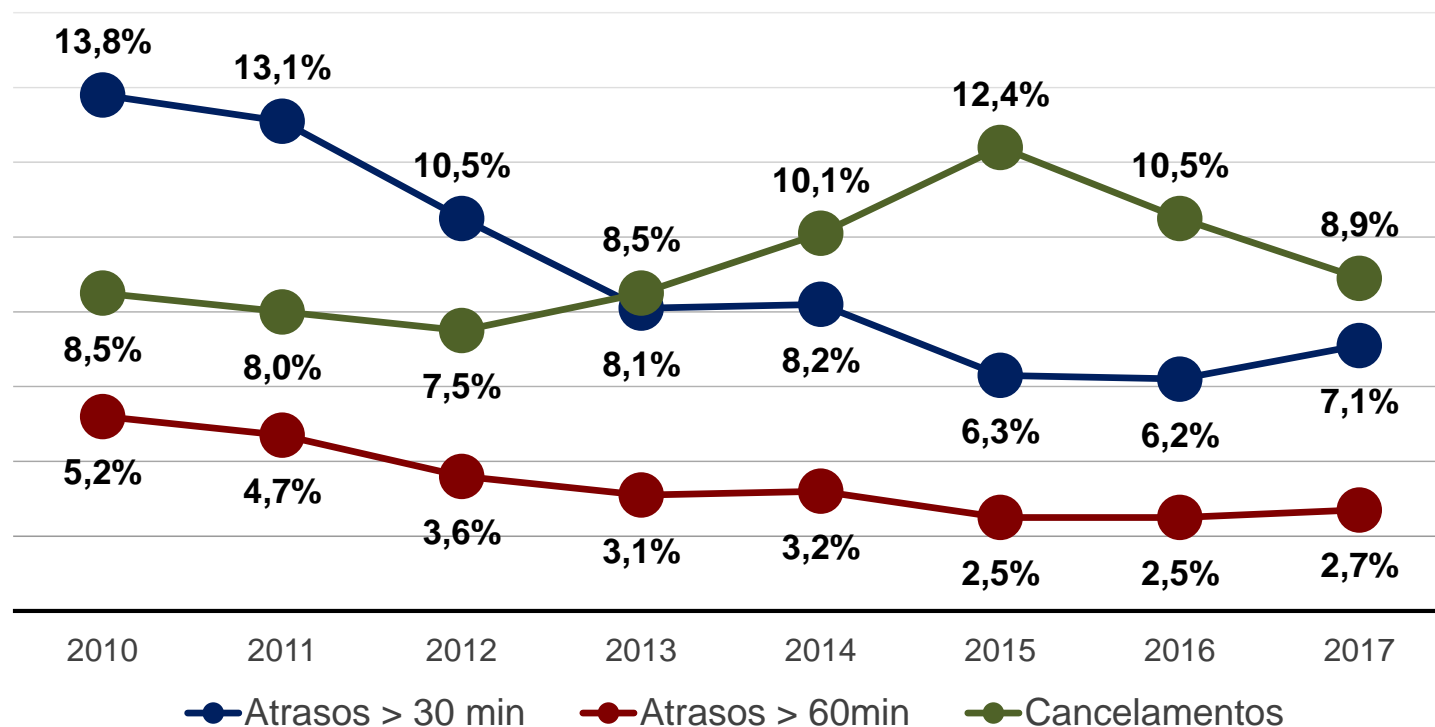
Custos da TAP com atrasos aumentam 40 milhões em 2018

O presidente da companhia aérea admite culpas próprias nos voos atrasados, que obrigam a pagar compensações aos passageiros. Desviar voos de Lisboa para o Porto? “Não resolvo o problema fugindo do problema”, respondeu Antonoaldo Neves.

(Larguesa, 2018)

Atrasos e cancelamentos

Proporção de atrasos e cancelamentos - Indústria



Recuperação de malha aérea

Aeronaves

- ✓ Desvio ou traslado sem passageiros
- ✓ Troca de aeronaves
- ✓ Aeronave reserva

Tripulantes

- ✓ Nova programação de escala
- ✓ Tripulante reserva

Passageiros

- ✓ Novo agendamento
- ✓ Transporte em outra companhia



Recuperação de malha aérea

G1

RORAIMA



Falta de combustível no aeroporto de Brasília atrasa voos em Boa Vista

(Chaves, 2018)

≡ O GLOBO ECONOMIA

Em todo o Brasil, 101 voos são cancelados por falta de combustível nos aeroportos

(Ventura, 2018b)

Dois casos foram r
Internacional de B

Por Alan Chaves, G1 F

26/05/2018 16h50 - Atualizad

Maior parte dos

≡ O GLOBO ECONOMIA

Manoel Ventura

26/05/2018 - 14:14 / 2

Chega a 115 o número de voos cancelados por falta de combustível nos aeroportos

Latam e Azul são empresas mais atingidas. Onze aeroportos da Infraero estão sem combustível

Manoel Ventura

25/05/2018 - 16:45 / 25/05/2018 - 20:10

(Ventura, 2018a)

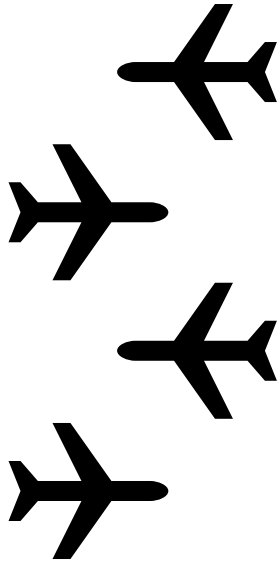
Padronização de frota

“the 737 Max, guarantees to Southwest Airlines a single-fleet [...] with all of the operational benefits associated with training, and schedule recovery and our maintenance programmes”

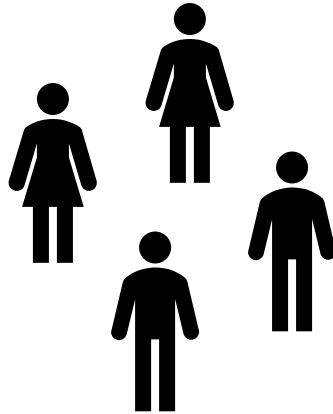
Southwest  **Mike Van De Ven**
Chief operating officer

(Ostrower, 2011)

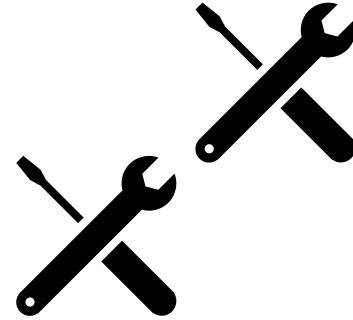
Padronização de frota



Aeronaves



Tripulação



Manutenção

Objetivo

- Investigar os efeitos da padronização de frota na capacidade de recuperação de escala



Padronização de frota

Efeitos

- ✓ **Reduz custos e aumenta o desempenho operacional**
(Seristö e Vepsäläinen, 1997; Kilpi, 2007; West e Bradley, 2008; Brüggén e Klose, 2010; Merkert e Hensher, 2011; Zou, Yu e Dresner, 2015)
- ✓ **Não tem efeito sobre custos**
(Zuidberg, 2014)
- ✓ **Capacidade de reduzir a receita e a margem de lucro**
(Zou, Yu e Dresner, 2015)
- ✓ **Eleva a capacidade de resposta sob eventos inesperados**
(Weiss e Maher, 2009)
- ✓ **Aspectos estratégicos como determinantes da padronização**
(Working paper | ITA)

Base de dados

Composição de Frota

Fabricantes, Famílias e Modelos



27 B737; 92 B738

Fabricantes 1
Famílias 1
Modelos 2



10 A318; 4 A319; 36 A320;
4 A332

Fabricantes 1
Famílias 2
Modelos 4



24 A319; 61 A320; 31 A321;
5 A350; 14 B763; 10 B773

Fabricantes 2
Famílias 4
Modelos 6



10 A320; 7 A332; 30 ATR72;
10 E190; 60 E195

Fabricantes 3
Famílias 4
Modelos 5

Modelo econométrico

$$Y = \beta_0$$

$$+ \beta_1 \ln \text{total RPK}_{kt} + \beta_2 \ln \text{fleet size}_{kt}$$

$$+ \beta_3 \ln \text{avg aircraft size}_{kt} + \beta_4 \ln \text{avg fleet age}_{kt}$$

$$+ \beta_5 \ln \text{network size}_{kt} + \beta_6 \ln \text{avg stage length}_{kt}$$

$$+ \beta_7 \ln \% \text{ pax service}_{kt} + \beta_8 \ln \text{fuel efficiency}_{kt}$$

$$+ \beta_9 \ln \text{aircraft utilization}_{kt} + \beta_{10} \ln \text{labor productivity}_{kt}$$

Airline Fleet Standardization $+ \beta_{11} \ln \text{AFS model}_{kt} + \beta_{12} \ln \text{AFS family}_{kt} + \beta_{13} \ln \text{AFS manufacturer}_{kt}$

$$+ \beta_{14} \ln \text{merger}_{kt} + \beta_{15} \ln \% \text{ ASK non-regional affiliates}_{kt}$$

$$+ \beta_{16} \ln \text{trend} \times \text{FSC incumbent}_{kt} + \beta_{17} \ln \text{trend} \times \text{FSC newcomer}_{kt}$$

$$+ \beta_{18} \ln \text{trend} \times \text{LCC incumbent}_{kt} + \beta_{19} \ln \text{trend} \times \text{LCC newcomer}_{kt}$$

$$+ \gamma_{\text{airline}} + \gamma_{\text{month}} + \epsilon_{kt}$$

Resultados

	ln reduced CASK			ln proportion of delayed flights		
	(1)	(2)	(3)	(4)	(5)	(6)
ln total RPK	0.0548	0.3323	0.2973	1.2603**	1.6628***	1.6187***
ln fleet size	-0.2709	-0.4697	-0.4171	-1.7903***	-1.8541***	-1.7848***
ln avg aircraft size	1.2514	1.6101**	1.4871**	2.0975	2.7877*	2.5846*
ln avg fleet age	0.1507*	0.1906**	0.1839**	-0.0372	-0.0061	-0.0140
ln network size	0.1108	0.2831	0.2681	0.8131*	1.1568**	1.1368**
ln avg stage length	-0.8308**	-0.5973*	-0.6407**	-1.2406	-0.6127	-0.6887
ln % pax service	-1.4279**	-1.0594	-1.0971	-2.5604**	-2.2410*	-2.2735*
ln fuel efficiency	-0.5368***	-0.5956***	-0.5742***	-0.4105	-0.5470*	-0.5103*
ln aircraft utilization	0.2992	0.1172	0.1439	-0.4958	-0.8395	-0.8002
ln labor productivity	-0.3542***	-0.5022***	-0.5013***	-0.5247**	-0.7768***	-0.7829***
AFS model	-0.3014**			-0.8325**		
AFS family		-0.5373***			-0.9236***	
AFS manufacturer			-0.5652***			-1.0006***
merger	-0.1410***	-0.1014**	-0.1066***	-0.3228***	-0.2253***	-0.2340***
ln % ASK non-regional affiliates	-0.6384	-0.3575	-0.4346	1.4955*	1.8822**	1.7649**
trend × FSC incumbent	-0.0360	-0.0691	-0.0608	0.5031**	0.4516*	0.4644*
trend × FSC newcomer	-0.0621	-0.1030	-0.0939	0.4834**	0.4207*	0.4342*
trend × LCC incumbent	-0.0369	-0.0725	-0.0643	0.5062**	0.4490*	0.4616*
trend × LCC newcomer	-0.0358	-0.0815	-0.0737	0.5252**	0.4440*	0.4556*
Adjusted R-squared	0.8626	0.8691	0.8687	0.7899	0.7919	0.7922
Nr observations	396	396	396	396	396	396

P-value: ***p<0.01, **p<0.05, *p<0.10

Resultados

	ln reduced CASK			ln proportion of delayed flights		
	(1)	(2)	(3)	(4)	(5)	(6)
ln total RPK	0.0548	0.3323	0.2973	1.2603**	1.6628***	1.6187***
ln	ln reduced CASK			ln proportion of delayed flights		
ln	(1)	(2)	(3)	(4)	(5)	(6)
ln						
ln total RPK	0.0548	0.3323	0.2973	1.2603**	1.6628***	1.6187***
ln fleet size	-0.2709	-0.4697	-0.4171	-1.7903***	-1.8541***	-1.7848***
ln % pax service	-1.4273	-1.0394	-1.0971	-2.3004	-2.2410	-2.2735
ln fuel efficiency	-0.5368***	-0.5956***	-0.5742***	-0.4105	-0.5470*	-0.5103*
ln aircraft utilization	0.2992	0.1172	0.1439	-0.4958	-0.8395	-0.8002
ln aircraft utilization	0.2992	0.1172	0.1439	-0.4958	-0.8395	-0.8002
AFS model	-0.3014**			-0.8325**		
AFS family		-0.5373***			-0.9236***	
AFS manufacturer			-0.5652***			-1.0006***
merger	-0.1410***	-0.1014**	-0.1066***	-0.3228***	-0.2253***	-0.2340***
ln % ASK non-regional affiliates	-0.6384	-0.3575	-0.4346	1.4955*	1.8822**	1.7649**
trend × FSC incumbent	-0.0360	-0.0691	-0.0608	0.5031**	0.4516*	0.4644*
trend × FSC newcomer	-0.0621	-0.1030	-0.0939	0.4834**	0.4207*	0.4342*
trend × LCC incumbent	-0.0369	-0.0725	-0.0643	0.5062**	0.4490*	0.4616*
trend × LCC newcomer	-0.0358	-0.0815	-0.0737	0.5252**	0.4440*	0.4556*
Adjusted R-squared	0.8626	0.8691	0.8687	0.7899	0.7919	0.7922
Nr observations	396	396	396	396	396	396

P-valor: ***p<0.01, **p<0.05, *p<0.10

Resultados

	ln reduced CASK			ln proportion of delayed flights		
	(1)	(2)	(3)	(4)	(5)	(6)
ln total RPK	0.0548	0.3323	0.2973	1.2603**	1.6628***	1.6187***
ln fleet size	-0.2709	-0.4697	-0.4171	-1.7903***	-1.8541***	-1.7848***
ln avg aircraft size	1.2514	1.6101**	1.4871**	2.0975	2.7877*	2.5846*
ln avg fleet age	0.1507*	0.1906**	0.1839**	-0.0372	-0.0061	-0.0140
ln network size	0.1108	0.2831	0.2681	0.8131*	1.1568**	1.1368**
	ln reduced CASK			ln proportion of delayed flights		
	(1)	(2)	(3)	(4)	(5)	(6)
ln network size	0.1108	0.2831	0.2681	0.8131*	1.1568**	1.1368**
ln labor productivity	-0.3542***	-0.5022***	-0.5013***	-0.5247**	-0.7768***	-0.7829***
ln labor productivity	-0.3542***	-0.5022***	-0.5013***	-0.5247**	-0.7768***	-0.7829***
AFS manufacturer merger	-0.1410***	-0.1014**	-0.1066***	-0.3228***	-0.2253***	-0.2340***
ln % ASK non-regional affiliates	-0.6384	-0.3575	-0.4346	1.4955*	1.8822**	1.7649**
trend × FSC incumbent	-0.0360	-0.0691	-0.0608	0.5031**	0.4516*	0.4644*
trend × FSC newcomer	-0.0621	-0.1030	-0.0939	0.4834**	0.4207*	0.4342*
trend × LCC incumbent	-0.0369	-0.0725	-0.0643	0.5062**	0.4490*	0.4616*
trend × LCC newcomer	-0.0358	-0.0815	-0.0737	0.5252**	0.4440*	0.4556*
Adjusted R-squared	0.8626	0.8691	0.8687	0.7899	0.7919	0.7922
Nr observations	396	396	396	396	396	396

P-valor: ***p<0.01, **p<0.05, *p<0.10

Resultados

	ln reduced CASK			ln proportion of delayed flights		
	(1)	(2)	(3)	(4)	(5)	(6)
ln total RPK	0.0548	0.3323	0.2973	1.2603**	1.6628***	1.6187***
ln fleet size	-0.2709	-0.4697	-0.4171	-1.7903***	-1.8541***	-1.7848***
ln avg aircraft size	1.2514	1.6101**	1.4871**	2.0975	2.7877*	2.5846*
ln avg fleet age	0.1507*	0.1906**	0.1839**	-0.0372	-0.0061	-0.0140
ln network size	0.1108	0.2831	0.2681	0.8131*	1.1568**	1.1368**
ln avg stage length	-0.8308**	-0.5973*	-0.6407**	-1.2406	-0.6127	-0.6887
ln % pax service	-1.4279**	-1.0594	-1.0971	-2.5604**	-2.2410*	-2.2735*
ln fuel efficiency	-0.5368***	-0.5956***	-0.5742***	-0.4105	-0.5470*	-0.5103*
ln aircraft utilization	0.2992	0.1172	0.1439	-0.4958	-0.8395	-0.8002
ln labor productivity	-0.3542***	-0.5022***	-0.5013***	-0.5247**	-0.7768***	-0.7829***
AFS model	-0.3014**			-0.8325**		

	ln reduced CASK			ln proportion of delayed flights		
	(1)	(2)	(3)	(4)	(5)	(6)
AFS model	-0.3014**			-0.8325**		
AFS family		-0.5373***			-0.9236***	
AFS manufacturer			-0.5652***			-1.0006***
Adjusted R-squared	0.8626	0.8691	0.8687	0.7899	0.7919	0.7922
Nr observations	396	396	396	396	396	396

P-valor: ***p<0.01, **p<0.05, *p<0.10

Considerações finais

- Analisar os efeitos da padronização nos cancelamentos de voos
- Controle de endogenia e instrumentação de modelos



Referências

- ABEAR. **Panorama 2017: o setor aéreo em dados e análises**. Brasília, 2018.
- ABDELGHANY, Ahmed; ABDELGHANY, Khaled. **Modeling applications in the airline industry**. Farnham: Ashgate Publishing, 2009
- ANAC. **Anuário do transporte aéreo 2017**. Brasília, 2018.
- BRÜGGEN, Alexander; KLOSE, Levin. How fleet commonality influences low-cost airline operating performance: Empirical evidence. **Journal of Air Transport Management**, v. 16, n. 6, p. 299-303, 2010.
- CHAVES, Alan. Falta de combustível no Aeroporto de Brasília atrasa voos em Boa Vista. **G1**, 26 mai 2018.
- GREENWOOD, Gemma. Flight disruption costs aviation industry US\$60 billion annually. **TravelDaily**, 18 out 2016.
- KILPI, Jani. Fleet composition of commercial jet aircraft 1952–2005: Developments in uniformity and scale. **Journal of Air Transport Management**, v. 13, n. 2, p. 81-89, 2007.
- LARGUESA, António. Custos da TAP com atrasos aumentam 40 milhões em 2018. **Jornal de Negócios**, 15 nov 2018.
- MARIANI, Carlotta. Disruption management in the airline industry. **Norwegian University of Science and Technology**. Master Thesis in Aerospace Engineering. 10 jun 2015.
- MERKERT, Rico; Hansher, David A. The impact of strategic management and fleet planning on airline efficiency – A random effects Tobit model based on DEA efficiency scores. **Transportation Research Part A**, v. 45, p. 686-695, 2011.
- OSTROWER, Jon. Commonality, performance tipped Southwest to 737 Max. **FlightGlobal**, Washington, DC, 18 dez 2011.
- SERISTÖ, Hannu; VEPSÄLAINEN, Ari PJ. Airline cost drivers: cost implications of fleet, routes, and personnel policies. **Journal of Air Transport Management**, v. 3, n. 1, p. 11-22, 1997.
- VENTURA, Manoel. Chega a 115 o número de voos cancelados por falta de combustível nos aeroportos. **O Globo**, 25 mai 2018a.
- VENTURA, Manoel. Em todo o Brasil, 101 voos são cancelados por falta de combustível nos aeroportos. **O Globo**, 26 mai 2018b.
- WEISS, Dan; MAHER, Michael W. Operational hedging against adverse circumstances. **Journal of Operations Management**, v. 1, n. 27, . 362-373, 2009.
- WEST, David; BRADLEY, John. Airline flight networks, cycle times, and profitability: 2004–2006. **Operations Management Research**, v. 1, n. 2, p. 129, 2008.
- ZOU, Li; YU, Chunyan; DRESNER, Martin. Fleet Standardization and Airline Performance. **Journal of Transport Economics and Policy**, v. 49, n. 1, p. 149-166, 2015.
- ZUIDBERG, Joost. Identifying airline cost economies: An econometric analysis of the factors affecting aircraft operating costs. **Journal of Air Transport Management**, v. 40, p. 86-95, 2014.

VI Semana da Qualidade da Informação do Transporte Aéreo

Painel 1: Simpósio de Economia do Transporte Aéreo (SETA 2018)

Capacidade de recuperação de malha aérea e os efeitos da padronização de frota

Rodolfo R. Narcizo

Alessandro V. M. Oliveira

Contato: RRN93@hotmail.com

