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# Are passengers less willing to pay for flying turboprops? An empirical test of the “turbo aversion hypothesis”

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### ABSTRACT

Turboprop airplanes are known for their fuel efficiency on short-haul routes and thus naturally have a competitive advantage over jets in regional air transport. In Brazil, however, the market share of turboprops has considerably decreased in regional routes since the early 2010s. One possible explanation for this trend is the “turbo aversion hypothesis” (TAH), in which passengers dislike flying in turboprops, making carriers in regional markets more prone to operate either regional or smaller narrow-body jets based on demand-side economics. We empirically test this hypothesis by employing an econometric model of air travel demand in Brazilian regional markets. We find strong evidence rejecting the TAH, suggesting that the cost-side economics of the falling fuel prices apparently fully explains the observed erosion of the turboprop participation in the market.

**“Passengers prefer jets over turboprops, viewing the former as quieter, faster, safer and more comfortable.”**

ARNOULT (2001) apud DRESNER, WINDLE and ZHOU (2002)

**“Online stated-choice survey confirmed a strong dislike for turboprops and indicated a clear materialization of turbo aversion.”**

HESS (2010)

**“Passengers perceive propeller aircraft as old; being the in-flight experience affected by noise, vibration and pressurization to a far greater extent.”**

HANLON (2007)

**“Turboprops are enjoying a comeback despite some passengers' aversion to planes with propellers. It is all about oil.”**

The Economist (2012)



The **main contribution** of the paper is the empirical test of the “Turbo Aversion Hypothesis” through the investigation of passenger’s willingness to pay for flights on routes flown by turboprops.

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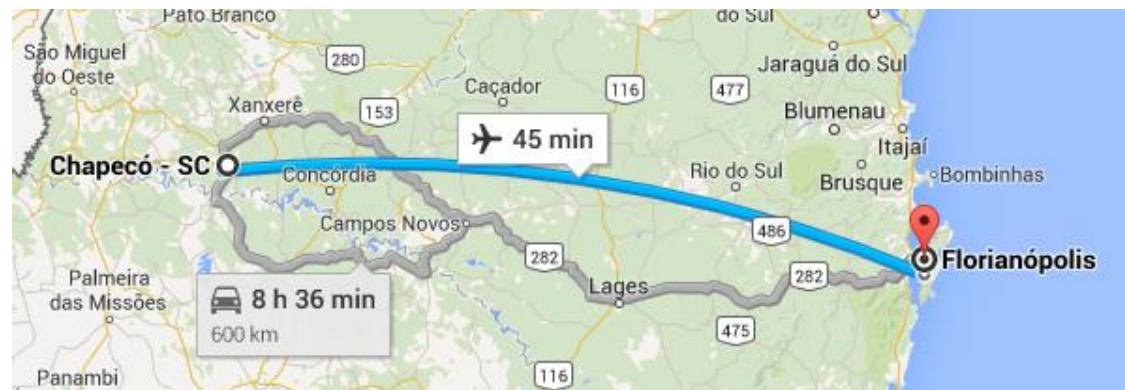
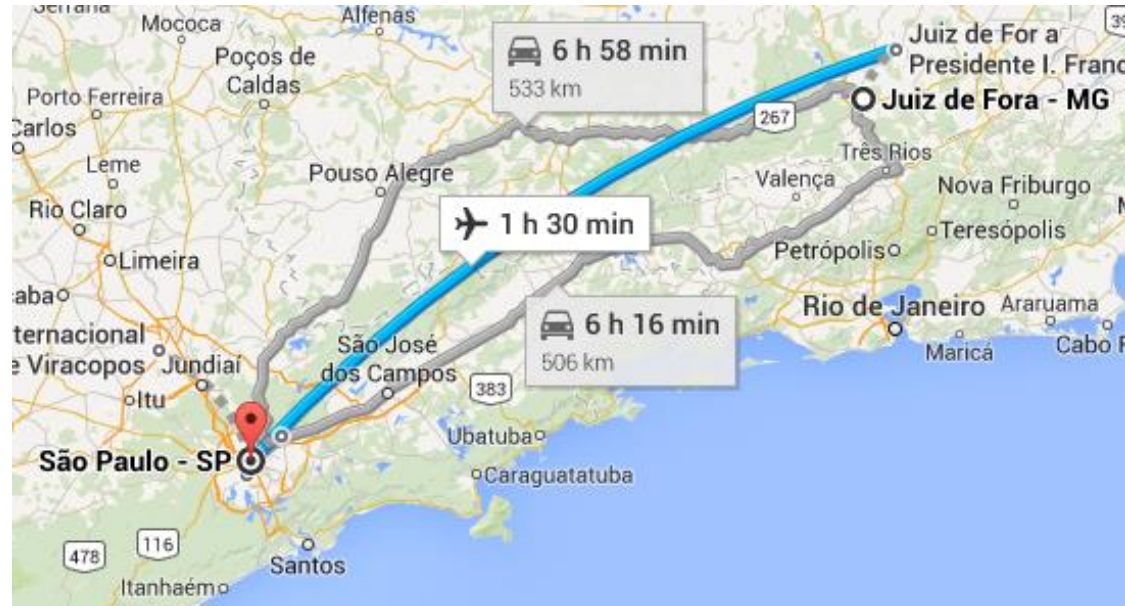
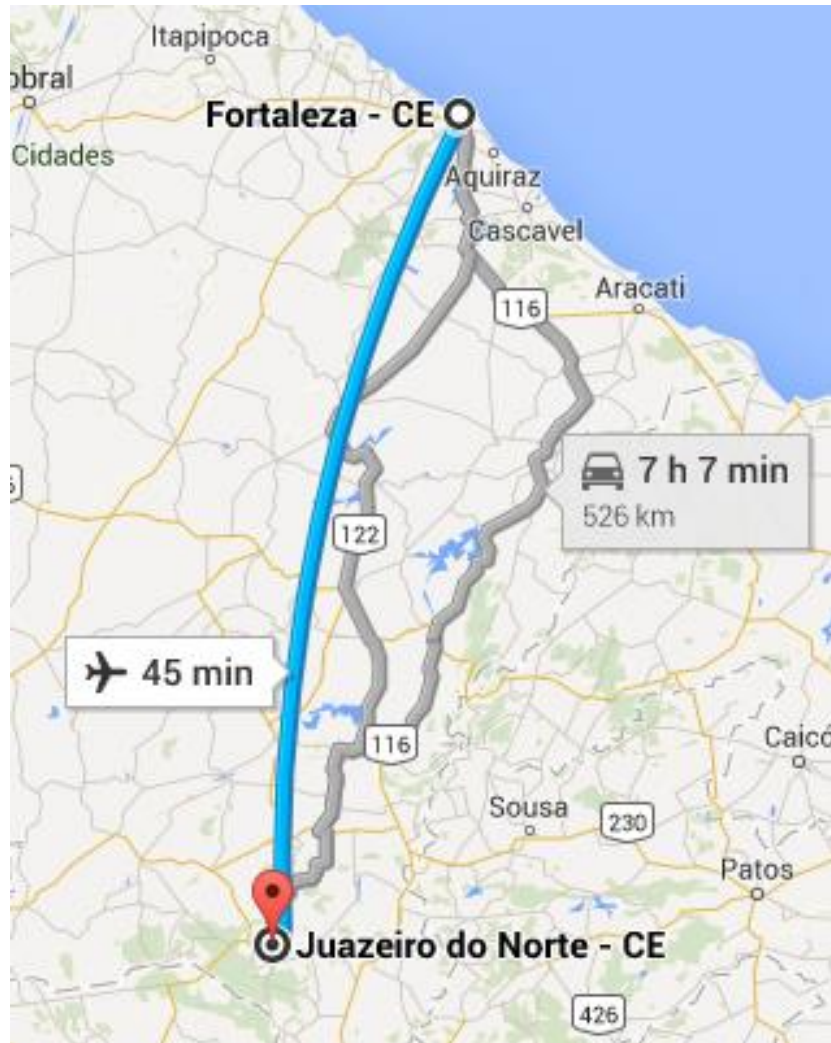
Are passengers less willing to pay for flying turboprops? An empirical test of the “turbo aversion hypothesis”



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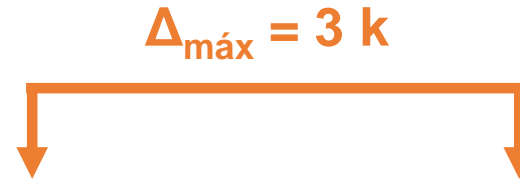
Unbalanced panel with 1051 Brazilian regional routes from 2010 to 2017 in 139 cities. **Final data set: # 29,388 observations.**



Data from:

ANAC  
INFRAERO  
IBGE  
IPEA  
Central Bank

**Brazilian regional flights increased 66% in the period. Turboprops' share reached 58% peak in 2009 and then dropped. Jets advanced in typical TPs market.**



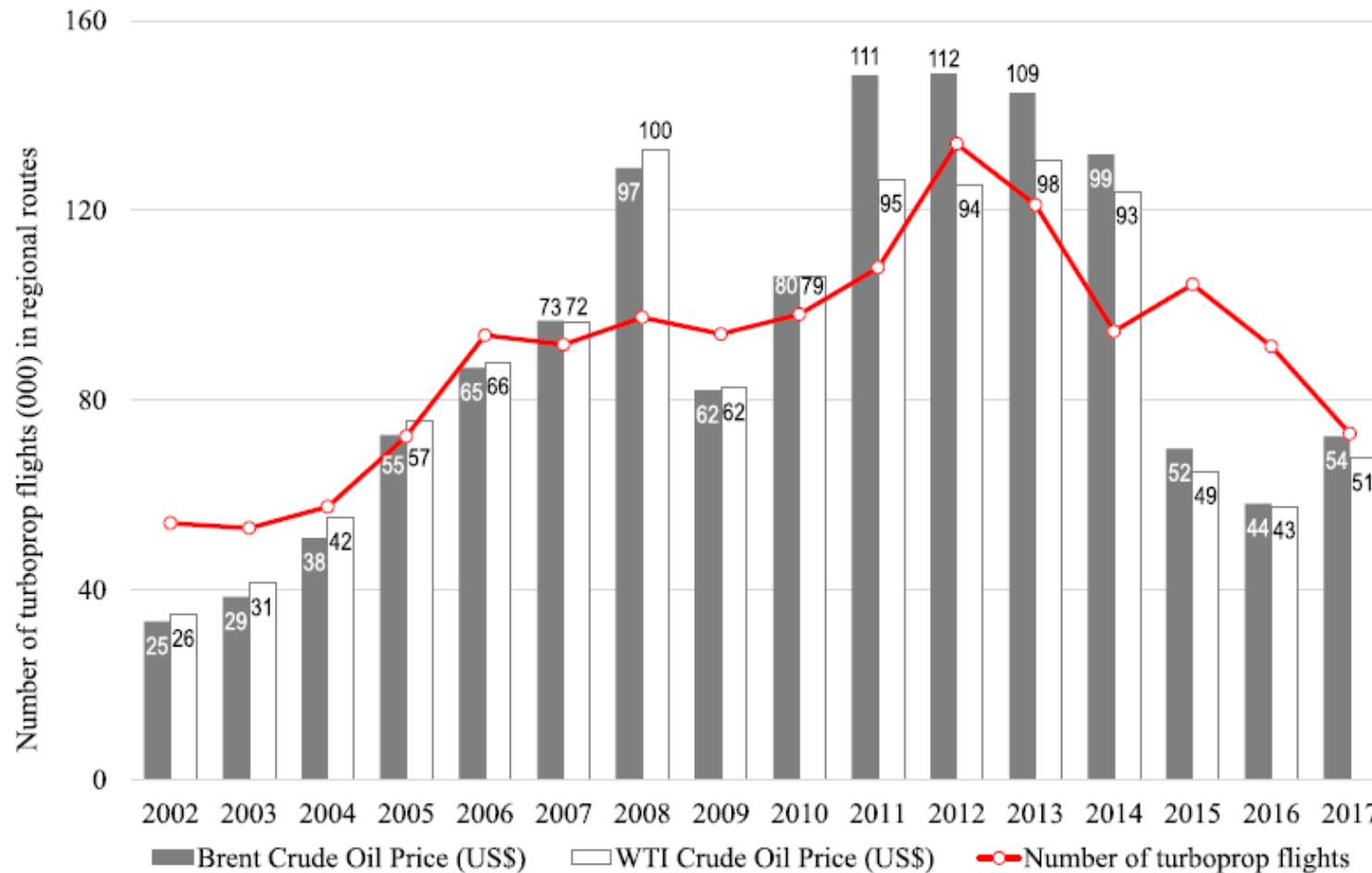
**Table 1**

Evolution of regional air transportation in Brazil.

Sources: National Civil Aviation Agency, Air Transportation Market Statistical Database – Monthly Traffic Report, Active Scheduled Flight Report – VRA, and Microdata of Commercial Air Fares Database, with own calculations.

Period		All regional routes								≤ 500 nm				≤7 weekly flights			
		pax (million)	avg fare (2018 R\$)	flights (000)	turboprops		jets		turboprops		jets		turboprops		jets		
					flights		flights		flights		flights		flights		flights		
					(000)	share	(000)	share	(000)	share	(000)	share	(000)	share	(000)	share	
(1)	2002–05	44	683	132	59	45%	73	55%	57	47%	65	53%	26	65%	14	35%	
(2)	2006–09	6.7	529	163	94	58%	69	42%	92	60%	61	40%	37	83%	8	17%	
(3)	2010–13	13.3	433	247	115	47%	132	53%	113	51%	111	49%	39	74%	14	26%	
(4)	2014–17	16.2	409	219	91	41%	128	59%	88	46%	102	54%	20	57%	16	43%	
% Variation																	
	(2)/(1)	52%	– 23%	23%	59%		– 6%		61%		– 6%		42%		– 43%		
	(3)/(2)	98%	– 18%	52%	22%		92%		23%		82%		5%		75%		
	(4)/(3)	21%	– 6%	– 11%	– 21%		– 3%		– 22%		– 8%		– 49%		14%		
	(4)/(1)	266%	– 40%	66%	53%		76%		54%		57%		– 23%		14%		

One explanation for decreasing turboprop flights is the **substantial drop in the oil barrel price.**



Pearson's correlation coefficient between the series is 0.85 (Brent) and 0.80 (WTI).

Fig. 1. Evolution of turboprop flights on Brazilian regional air transport routes against crude oil price.

Sources: National Civil Aviation Agency, Active Scheduled Flights Report (VRA), and Institute for Applied Economic Research – IPEA (WTI and Brent prices). Number of turboprop flights in thousands. See the description of the data set for details on the definition of regional airline routes.

**Estimate the price elasticity of demand** for regional flights and their shifters: a way of understanding whether purchase behavior would be affected by the aircraft type.

$$\begin{aligned} \ln \text{weekly pax}_{kt} = & \beta_1 \ln \text{grav gdp per capita}_{kt} + \beta_2 \ln \text{flight frequencies}_{kt} \\ & + \\ & \beta_3 \ln \text{mean served cities}_{kt} + \beta_4 \text{presence major carriers}_{kt} + \\ & \beta_5 \ln \text{yield}_{kt} + \beta_6 \ln \text{yield}_{kt} \times \text{business}_k + \\ & \beta_7 \ln \text{yield}_{kt} \times \text{intermodal}_k + \beta_8 \ln \text{yield}_{kt} \times \text{monopoly}_{kt} + \\ & \beta_9 \ln \text{yield}_{kt} \times \text{turboprop}_{kt} + \gamma_k + \gamma_t + u_{kt}, \end{aligned}$$



# Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ln weekly pax	ln weekly pax	ln weekly pax	ln weekly pax	ln weekly pax	ln weekly pax	ln weekly pax
ln grav gdp per capita	0.7208***	0.5433***	0.4508***	0.4317***	0.5240***	0.3526***	0.3291**
ln flight frequencies	0.3788***	0.3334***	0.3313***	0.3635***	0.3146***	0.3131***	0.2904***
ln mean served cities	0.0619***	0.0756**	0.0991***	0.1234***	0.0924***	0.1210***	0.1145***
presence major carriers	0.1957***	0.2668***	0.2882***	0.2674***	0.2690***	0.3202***	0.3420***
ln yield	−1.2353***	−2.0611***	−2.3106***	−1.6650***	−0.8663***	−3.4519***	−4.2010***
ln yield ×business		2.4308**	3.3166***	2.2391**		5.7048***	7.0450***
ln yield ×intermodal		−3.8973***	−4.8041***	−3.6756***	−4.1309***	−5.4284***	−6.5368***
ln yield ×monopoly		0.9789***	0.9152***		0.7213***	0.9650***	1.4153***
ln yield ×turboprop			−0.0423	−0.0334	−0.1482	−0.1201	0.0376
city-pair fixed effects	yes	yes	yes	yes	yes	yes	yes
time fixed effects	yes	yes	yes	yes	yes	yes	yes
estimator	2SGMM	2SGMM	2SGMM	2SGMM	2SGMM	LIML	LIML
instruments set	over-identif	over-identif	over-identif	over -identif	over -identif	over-identif	just -identif
estimated median price-elasticity	−1.2353***	−1.4263***	−1.5120***	−1.3989***	−1.5024***	−1.6459***	−1.8151***
Adjusted R-squared	0.9515	0.9518	0.9518	0.9518	0.9515	0.9518	0.9518
RMSE statistic	0.4250	0.4238	0.4239	0.4238	0.4249	0.4239	0.4239
KP underidentif statistic	52.5117	24.0132	50.1926	64.8891	84.1797	50.1926	39.4975
KP underidentif p-value	< 0.0001	0.0023	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
CD weak identif statistic	43.3434	4.4020	6.4877	7.5462	8.4564	6.4877	11.2621
KP weak identif statistic	17.8833	2.2214	3.2011	4.7311	6.2182	3.2011	8.1532
J test statistic	1.1299	5.7020	11.4305	9.9951	12.3703	8.9788	n/a
J test p-value	0.5684	0.5749	0.4079	0.4409	0.2610	0.6239	n/a
Nr observations	29,388	29,388	29,388	29,388	29,388	29,388	29,388

Notes: Results produced by the two-step feasible efficient generalized method of moments estimator (2SGMM); statistics robust to heteroscedasticity and autocorrelation. “over-identif” and “just-identif” mean estimation of, respectively, an over-identified and a just-identified model. P-value representations: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.10. Estimated price elasticity in (2)–(7) extracted at the sample mean of the interaction variables.

## Our conclusions:

**Rejection of Turbo Aversion Hypothesis.** Passengers are not willing to pay less for a turboprop flight.

Passenger profile, market structure and intermodal competition exposure are **key drivers of price-elasticities**.

Observed **growth of jets** seems to be mainly related to the **decline in fuel prices and their operating advantages**: higher range, speed and productivity.

Airlines with both TP and Jets in their fleets may take **fleet assignment decisions solely based on cost economics** rather than on passengers' preference.

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**Thank you.  
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