Who Stopped Flying around of September 11th?

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Abstract

The terrorist acts of September 11th, 2001, affected people's fears of and demand for flying. This paper presents the first set of empirical results of the effects of September 11th on flying behaviour. This paper Women, the less-educated and Americans were most likely to have stopped flying around 9/11. Significant differences exist between Westerner and European reactions to September 11th, with Europeans (Westerners) being alarmed (reassured) by their experiences of relatively low-risk (medium-risk) incidents. Westerners also appear to be most affected by the experiences of friends and families.

JEL Classification:

Keywords:

Acknowledgements: The author would like to thank Jurgen Brauer, Paul Dunne, Peter Howells and Samuel Perlo-Freeman for helpful comments on earlier drafts. Thanks also go to Philip Lawrence and Matthias Schmidlin for their insights gained through helpful discussions.

Address for Correspondence: Dr Don J. Webber, School of Economics, University of the West of England, Bristol, BS16 1QY, UK. Tel: (+44/0) 117 32 82741; Fax: (+44/0) 117 32 82295; Email: <u>Don.Webber@uwe.ac.uk</u> On September 11th, 2001 (9/11) two passenger jets crashed into the World Trade Centre in New York, USA. A third plane crashed into the Pentagon and a fourth was forced to the ground near Pittsburgh. These incidents were the result of hijackings that were organised in various countries around the world under the guise of al-Qaeda. This 'globalisation of terrorism' affected people's perceptions of aviation safety and this influenced people's demand for flying.

One immediate effect of 9/11 on flying behaviour was to make people consider whether they should travel by air at all, and whether they should consider either not travelling or travelling by an alternative mode of transport. Some people decided that flying was too risky and so they stopped flying altogether, albeit temporarily. The consumption patters of services and goods consumed overseas altered because the probability of travelling abroad was affected by changes in aviation safety perceptions.

In this study we examine the characteristics of individuals who reacted the most to 9/11 by stopping flying altogether. To undertake this task, we draw on data which were collected in the summer of 2001 with the purpose of identifying frequent flyers' perceptions of aviation safety. The questionnaire was circulated to the same respondents in early 2002 to identify changes in flying behaviour.

1. Data Set

2. Descriptive Statistics

The events of 9/11 stand in line with Sandler's (1992) observation that the international community has experienced an ever-increasing threat of terrorism since the late 1960s.

3. Modelling Approach

Given that the dependent variable is whether or not the respondent stopped flying, it is appropriate to employ a logit modelling framework and assume a variance in the distribution of $\pi^2/3$. The discrete dependent variable, s_i , can be defined as:

$$s_i = \begin{cases} 1 & \text{if the individual stopped flying between the two sweeps} \\ 0 & \text{if the individual did not stop flying between the two sweeps} \end{cases}$$

The logit model is therefore the following:

$$\log \frac{p_i}{1-P_i} = \beta_0 + \sum_{j=1}^k \beta_j x_{ij}$$

where the left-hand side of this equation is the *log-odds* ratio, P_i is the probability that the individual stopped flying, β are coefficients and x_{ij} are independent explanatory variables grounded in the two sweeps, *i* and *j*.

To test whether $\beta_{2001} = \beta_{2002}$, we estimate $s_{it} = \beta X_{it}$ and employ dummy variables to identify whether the variable had different effects before or after 9/11. Hence we estimate the following model:

$$p_{it} = \alpha + \beta X_i + \beta_2 X_i D_{2002}$$

If there has been no change in the parameter estimates between the two sweeps then the parameters on the dummy variables should be insignificantly different from zero. Maximisation of the likelihood function:

$$L = \prod_{s_i=1} P_i \prod_{s_i=0} (1 - P_i)$$

is accomplished by nonlinear estimation methods using STATA version 7.0.

4. Results

The purpose of this empirical investigation is twofold: first, we seek to examine whether the factors influencing stopping behaviour is different depending on the respondent's country of origin and, second, we seek to identify whether the factors influencing stopping behaviour differed before and after 9/11.

To investigate the first objective, individuals were pooled to create the first set of results; these results are presented in column 1 of Table X. In subsequent sets of estimations the respondents are split according to their country of origin. Column 2 is the set of results for individuals who originate only from the USA and the UK. Column 3 presents the results of estimations that include individuals from 'Western countries', which includes Canada, the US, and countries in Europe and Australasia. Finally, set four, presented in column 4, are the results of estimations of Europeans (excluding people from the UK).

All regressions are ordinary logits where the dependent variable has a value equal to one if the individual can be identified as having stopped flying between the two sweeps and equal to

zero if the individuals did not stop flying between the two sweeps; we explicitly assume that if anyone stopped flying between the two sweeps then this stopping behaviour is a direct result of 9/11.

To undertake the second objective, Chow tests were employed to identify whether the inpact of each variable was statistically significantly different in the second sweep (see Gould, 1999). All full set regressions are estimated in the Chow test format and a general to specific variable deletion method is then undertaken using likelihood ratio (chi²) tests for excluded variables using group and individual variable deletions. The final, reduced model juxtaposes the full set model for each sample group. All results were re-estimated using a robust command to identify whether the errors were independently distributed; in all cases, the robustness checks indicate that heteroskedasticity was not affecting the results.

The independent variables are clustered according to a) personal characteristics, b) personal flying characteristics, c) attitude to media sensationalisation of aviation incidents, d) personal experiences of aviation safety incidents and e) indirect experiences of aviation safety incidents (i.e. respondents reporting that their immediate friends or family had experienced specific aviation safety incidents).

The results for the whole sample indicate the following. Personal characteristics were important: *Males* and those with a *Higher Degree* were less likely to have stopped flying because of 9/11. However, *Americans* were much more likely to have stopped flying than non-Americans. All of these variables were still statistically significant after the likelihood ratio test for excluded variables.

Those who were not *Relaxed on Plane* in sweep 1 were more likely to have stopped flying. If the respondent was a *Frequent Flyer* and if they normally flew on *National Carriers* then the respondent was also more likely to have stopped flying because of 9/11. However, of these three variables, only *Relaxed on Place* remained in the equation after the likelihood ratio test for excluded variables.

Interestingly, perceptions of the extent that *TV Sensationalisation* and *Aviation Journal Sensationalisation* occurred for aviation safety incidents did not affect stopping behaviour and this did not appear to have changed because of 9/11.

Experiences of individuals of aviation safety related incidents did have an affect in stopping behaviour. Personal experiences of low risk incidents had a positive effect on stopping, so if the respondent had *Experienced Low Risk* aviation safety incidents then the individual was more likely to have stopped flying because of 9/11. However, the experience of the medium risk aviation safety events had a negative effect, although it is was not statistically significant at the 10% level. The opposite effects of these two variables can be explained in the following way. To have experienced a low-risk aviation incident will have the respondent more concerned about aviation safety level and cause anxiety about survival rates should their next experience of aviation safety incidents be more severe. 9/11 would have reduced confidence in aviation safety further and hence a positive coefficient on *Experience Low Risk* is plausible. However, if the respondent had experience a more serious medium-risk event then the respondent would recognise that the levels of safety were high and that strategies were in place for dealing with severe aviation safety incidents. This would increase the confidence that the respondent had of aviation safety and reduce the impact that 9/11 had on the likelihood that the individual stopped. They would recognise that 9/11 was more of a terrorist incident than a safety related incident.

Indirect experiences, i.e. where the respondent reports that their *Friends / Family Experienced Medium Risk* aviation incidents, had a positive effect on the likelihood that the respondent was going to stop flying because of 9/11. This will have made the respondent more concerned about aviation safety levels and cause anxiety about survival rates should their next experience of aviation safety incidents be as severe.

The likelihood ratio test for excluded variables reduced the number of variables included in the regression to six. As stated above, the first personal characteristic variables remained statistically significant at traditional levels of significance. However the personal flying characteristics of *Frequent Flyer* and *Fly National Carriers* were both excluded from the model. *Experience Low Risk* incidents became insignificant while *Experienced Medium Risk* incidents became statistically significant. These results are relatively stable

References:

Gould, W. (StataCorp) (1999), *Pooling data and performing Chow tests in linear regression*, downloaded from <u>http://www.stata.com/support/faqs/stat/awreg.html</u> on 02/July/04 at 14.45 GMT.

	(1)		(2)		(3)		(4)	
Variable	All Countries		US and UK		Westerners		European (non-UK)	
	Full Set	Reduced Set	Full Set	Reduced Set	Full Set	Reduced Set	Full Set	Reduced Set
n	11	.86	30	54	80	50	4.	36
Male	-1.033 (0.301)***	-0.854 (0.281)***	-0.838 (0.704)		-0.803 (0.398)**	-0.751 (0.375)**	-0.888 (0.651)	-0.954 (0.555)*
Age	0.139 (0.173)		0.374 (0.418)		0.026 (0.208)		-0.445 (0.313)	-0.499 (0.278)*
Degree	0.490 (0.363)		0.158 (0.626)		0.516 (0.447)		0.153 (0.955)	
Higher Degree	-0.654 (0.252)***	-0.540 (0.238)**	-1.271 (0.602)**	-1.164 (0.545)**	-0.486 (0.303)		0.231 (0.451)	
Travel Class	0.184 (0.126)		-0.020 (0.273)		0.135 (0.151)		0.167 (0.224)	
American	1.166 (0.394)***	1.079 (0.381)***	1.954 (0.567)***	1.727 (0.492)***	1.212 (0.412)***	1.160 (0.398)***	-	-
Frequent Flyer (01)	0.193 (0.098)**		0.203 (0.234)		0.213 (0.121)*	0.186 (0.098)*	0.162 (0.184)	
Frequent Flyer (DUM)	-0.178 (0.141)		0.030 (0.322)		-0.116 (0.172)		-0.377 (0.266)	
Relaxed on Plane (01)	-0.605 (0.189)***	-0.583 (0.130)***	-0.926 (0.395)**	-0.727 (0.270)***	-0.649 (0.222)***	-0.583 (0.153)***	-0.872 (0.356)**	-0.728 (0.212)***
Relaxed on Plane (DUM)	0.042 (0.261)		0.498 (0.571)		0.159 (0.301)		-0.273 (0.471)	
Fly National Carriers (01)	-0.283 (0.169)*		-0.004 (0.351)		-0.205 (0.198)		-0.498 (0.333)	
Fly National Carriers (DUM)	0.162 (0.233)		-0.403 (0.521)		0.167 (0.278)		0.513 (0.440)	
TV Sensationalise (01)	0.169 (0.163)		0.093 (0.333)		0.156 (0.193)		0.274 (0.318)	
TV Sensationalise (DUM)	-0.372 (0.231)		-0.751 (0.487)	-0.556 (0.293)*	-0.500 (0.269)*	-0.291 (0.175)*	-0.458 (0.422)	
Aviation Journals Sensationalise (01)	0.011 (0.176)		-0.013 (0.400)		0.005 (0.226)		-0.143 (0.351)	
Aviation Journals Sensationalise (DUM)	0.142 (0.236)		-0.060 (0.557)		0.082 (0.300)		0.534 (0.452)	
Experience Low Risk (01)	0.355 (0.228)***		0.119 (0.502)		0.321 (0.270)		0.645 (0.396)	0.568 (0.278)**
Experience Low Risk (DUM)	-0.392 (0.298)		-0.751 (0.699)		-0.384 (0.375)		-0.319 (0.531)	
Experience Medium Risk (01)	-0.415 (0.181)	-0.215 (0.114)*	-0.100 (0.340)		-0.291 (0.202)	-0.243 (0.134)*	0.249 (0.304)	
Experience Medium Risk (DUM)	0.197 (0.234)		-0.343 (0.449)		-0.016 (0.269)		0.156 (0.420)	
Friends / Family Exp Low Risk (01)	-0.147 (0.210)		-0.511 (0.446)		-0.110 (0.247)		-0.109 (0.384)	
Friends / Family Exp Low Risk (DUM)	0.356 (0.289)		0.905 (0.598)		0.416 (0.347)		0.267 (0.538)	
Friends / Family Exp Medium Risk (01)	0.281 (0.159)***	0.281 (0.090)***	0.277 (0.332)		0.198 (0.185)	0.234 (0.104)**	0.144 (0.286)	
Friends / Family Exp Medium Risk (DUM)	-0.051 (0.209)		0.193 (0.436)		0.033 (0.242)		0.055 (0.381)	
Constant	-2.335 (0.483)***	-1.868 (0.286)***	-2.238 (0.889)**	-2.954 (0.311)	-2.737 (0.600)***	-2.179 (0.383)***	-3.404 (1.087)***	-3.019 (0.760)***
Log-likelihood	-291.054	-300.143	-71.522	-77.167	-202.152	-206.963	-91.712	-96.702
Likelihood Ratio Chi ²	74.66***	56.65***	33.85*	22.56***	51.36***	41.74***	35.05*	25.07***
Pseudo R ²	0.114	0.086	0.191	0.128	0.113	0.092	0.160	0.115
Likelihood Ratio Chi ² Test for Excluded		18.18		11.29		9.62		9.98
Variables (Prob > Chi^2)	-	(0.444)	=	(0.938)	-	(0.919)	-	(0.953)

Table X: Ordinary Logistic Regression: Who Stopped Flying?

Notes: The dependent variable in each regression is *Stopped*. Standard errors are in parentheses. Robustness checks indicate that heteroskedasticity is not affecting the results.

Appendix: Data Definitions, Means and Standard Deviations

Names of Variables	Definitions
Stopped	= 1 if they stopped flying = 0 else
Male	= 1 if Male; = 0 else
Age	= 4 if the respondent is aged over 50 ; = 3 if the respondent is aged between 36 and 50 ; = 2 if the respondent is aged between 25 and 35 ; = 1 if the respondent is aged less than 25;
Degree	= 1 if the respondent has a university/college degree: = 0 else
Higher Degree	= 1 if the respondent has a higher degree (Masters/PhD/); = 0 else
American	= 1 if the respondent is from the USA: $= 0$ else
	= 5 if the respondent makes more than 20 round trips per year $= 4$ if the respondent makes between 16 and 20 round trips per
Frequent Flyer	year; = 3 if the respondent makes between 11 and 15 round trips per year; = 2 if the respondent makes between 6and 10 round trips per year; = 1 if the respondent makes between 6 and 5 round trips per year; = 1 if the respondent makes between 0 and 5 round trips per year.
Relaxed on Plane 1	The respondents were asked their extent of agreement with the statement: "I always feel relaxed once in the aircraft". The value $= 5$ if the response was 'strongly agree'; $= 4$ if the response was 'agree'; $= 3$ if the response was 'neither agree nor disagree'; $= 2$ if the response was 'disagree': $= 1$ if the response was 'strongly disagree'.
Relaxed on Plane 2	As Relaxed on Plane 1, except for sweep 2
A Belayed on Plane	= the change in the value of <i>Relaxed on Plane</i> between sweeps 1 and 2.
	-4 if the recondent travels first class: -3 if the recondent travels business class: -3 if the recondent travels premium
Travel Class	= + 1 the respondent daves in steass, = 5 if the respondent daves dusiness class, = 2 if the respondent daves plentum economy class: = 1 if the respondent travels economy class
Fly National Carriers	The respondents were asked their extent of agreement with the statement: "I usually fly on national carriers". The value = 5 if the response was 'strongly agree'; = 4 if the response was 'agree'; = 3 if the response was 'neither agree nor disagree'; = 2 if the response was 'disagree'; = 1 if the response was 'strongly disagree'.
Aviation Journals Sensationalise 1	The respondents were asked their extent of agreement with the statement: "I always feel relaxed once in the aircraft". The value $= 5$ if the response was 'strongly agree'; $= 4$ if the response was 'agree'; $= 3$ if the response was 'neither agree nor disagree'; $= 2$ if the response was 'disagree'; $= 1$ if the response was 'strongly disagree'.
Aviation Journals Sensationalise 2	As Aviation Journals Sensationalise 1, except for sweep 2
Δ Aviation Journals Sensationalise	= the change in the value of Aviation Journals Sensationalise between sweeps 1 and 2.
TV Sensationalise 1	The respondents were asked their extent of agreement with the statement: "I always feel relaxed once in the aircraft". The value $= 5$ if the response was 'strongly agree'; $= 4$ if the response was 'agree'; $= 3$ if the response was 'neither agree nor disagree'; $= 2$ if the response was 'disagree'; $= 1$ if the response was 'strongly disagree'.
TV Sensationalise 2	As TV Sensationalise 1, except for sweep 2
A TV Sensationalise	= the change in the value of TV Sensationalise between sweeps 1 and 2.
Media Sensationalise 1	The respondents were asked their extent of agreement with the following categories about their perception of the degree of exaggeration or sensationalisation of aviation safety issues: 'TV news, such as CNN/BBC', 'General Journals such as Newsweek', 'Aviation journal such as Aviation Week', 'Newspapers such as the Herald Tribune, The Times', 'Internet', 'Radio'. The value for each category was = 5 if the response was 'strongly agree'; = 4 if the response was 'agree'; = 3 if the response was 'neither agree nor disagree'; = 2 if the response was 'disagree'; = 1 if the response was 'strongly disagree'. This variable sums all responses to guage a perception of the extent of sensationalisation of all media of aviation safety issues.
Media Sensationalise 2	As Media Sensationalise 1, expect for sweep 2
A Madia Congetionaliza	= the change in the value of <i>Media Sensationalise</i> between sweeps 1 and 2
	= the number of experiences of the respondent of relatively 'low-risk' aviation incidents as a passenger on a commercial
Experience Low Risk 1	aircraft. These include: in-flight turn-back, turbulence, and unruly passenger behaviour.
Experience Low Risk 2	As Experience Low Risk 1, expect for sweep 2
Δ Experience Low Risk	= the change in the value of <i>Experience Low Risk</i> between sweeps 1 and 2.
E-mariana Madiana Biak 1	= the number of experiences of the respondent of relatively 'medium-risk' aviation incidents as a passenger on a commercial
Experience Medium Risk 1	aircraft. These include: engine failure, lightning strike, aborted takeoff, failure of cabin pressure, and aborted landing.
Experience Medium Risk 2	As Experience Medium Risk 1, expect for sweep 2
Λ Experience Medium Risk	= the change in the value of <i>Experience Medium Risk</i> between sweeps 1 and 2.
Experience Terrorist Acts 1	= 1 if the respondent has experienced a terrorist act as a passenger on a commercial aircraft.
Experience Terrorist Acts 2	As Experience Terrorist Acts 1, expect for sweep 2
A Experience Terrorist Acts	= the change in the value of <i>Experience Terrorist Acts</i> between sweeps 1 and 2.
Experience Accidents 1	= 1 if the respondent has experienced an accident as a passenger on a commercial aircraft
Experience Accidents 2	As Experience Accidents1, expect for sweep 2
Λ Experience Accidents	= the change in the value of <i>Experience Accidents</i> between sweeps 1 and 2.
Friends / Family Exp Low Risk 1	= the number of experiences the respondent reports his/her friends or family have experienced of relatively 'low-risk' aviation incidents as passengers on a commercial aircraft. These include: in-flight turn-back, turbulence, and unruly passenger behaviour.
Friends / Family Exp Low Risk 2	As Friends / Family Exp Low Risk 1, expect for sweep 2.
A Friends / Family Eyn Low Pick	= the change in the value of <i>Friends / Family Exp Low Risk</i> between sweeps 1 and 2.
Z FICIUS / Fainity Exp Low Risk	= the number of experiences that the respondent reports his/her friends or family have experienced of relatively 'medium-risk'
Friends / Family Exp Medium Risk 1	aviation incidents as passengers on a commercial aircraft. These include: engine failure, lightning strike, aborted takeoff, failure of cabin pressure, and aborted landing.
Friends / Family Exp Medium Risk 2	As Friends / Family Exp Medium Risk 1, expect for sweep 2
Δ Friends / Family Exp Medium Risk	= the change in the value of Friends / Family Exp Medium Risk between sweeps 1 and 2.
Friends / Family Exp Terrorist Acts 1	= 1 if the respondent reports his/her friends or family has experienced a terrorist act as passengers on a commercial aircraft.
Friends / Family Exp Terrorist Acts 2	As Friends / Family Exp Terrorist Acts 1, expect for sweep 2
Δ Friends / Family Exp Terrorist Acts	= the change in the value of Friends / Family Exp Terrorist Acts between sweeps 1 and 2.
Friends / Family Exp Accidents 1	= 1 if the respondent reports his/her friends or family has experienced an accident as passengers on a commercial aircraft.
Friends / Family Exp Accidents 2	As Friends / Family Exp Accidents 1, expect for sweep 2
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