

Cancellations and their Relationship to and Impact on Airline Service Quality

This paper is the first attempt by the authors of the 'Service Disquality Index' to relate cancellations to the index, and to model the impact of cancellations on overall airline service quality. Cancellations as reported in the Air Travel Consumer Report are compared and correlated to the SDI. Additionally, the impact of cancellations are added into the SDI and examined to measure the possible impact of cancellations on redistributing the ranking of airlines in the index. The inclusion of cancellations does not impact the ranking of the airlines using the SDI, but does support the inclusion of cancellations in the SDI going forward as a truer measure of airline service disquality.

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Two major airline service quality measurement systems currently exist that use the same source for data as input into their derived airline service quality measures. Both the Airline Quality Rating (aqr.aero) and Rhoades and Waguespack's 'Service Disquality Index' (SDI) use statistics provided by the Department of Transportation (DOT) in the monthly Air Travel Consumer Report as the basis for analysis. However, the Air Travel Consumer Report is not a static report that remains unchanged. New data fields and statistics are introduced into the report by the DOT. One new data point introduced in the past few years, cancellations by the major airlines, is the focus of this paper. To date, neither the Service Disquality Index nor AQR has utilized the cancellation data in their analysis.

The United States Department of Transportation has published information since 1987 relating to various aspects of airline service quality including on-time performance, overbooking, mishandled baggage, and customer complaints (<http://airconsumer.ost.dot.gov/reports>). This information, contained in the Air Travel Consumer Report, has served as the basis for ongoing research by two groups of scholars interested in airline service quality. One group of scholars has published an annual Airline Quality Rating (www.aqr.aero) report since 1991 (Bowen and Headley, 2007). The second group of scholars is based at Embry-Riddle Aeronautical University. Using similar data in a somewhat different ranking system, the researchers have reported that service quality for the major US carriers

14:15	Flight	Remarks
15:10	FR1187	Proceed To Departures
15:15	EZY019	Cancelled
15:25	EZY2555	Cancelled
15:35	EZY167	Cancelled
15:40	EZY2163	Cancelled
15:50	ZB834	Checkin Desks 10-12
16:05	EZY073	Cancelled
16:20	FR337	Dublin
16:30	EZY021	Cancelled
17:15	EZY2347	Cancelled
17:35	RE546	Waterford
17:35	TOM3027	Las Palmas
17:40	EZY075	Cancelled
17:45	EZY2203	Cancelled
18:00	EZY2507	Cancelled
18:05	EZY147	Cancelled
18:10	EZY023	Cancelled
18:15	EZY169	Cancelled

improved from 1987-1993, then deteriorated from 1994-2001, showed a marked improvement from 2001 to 2003, but has lately deteriorated again. The improvement since 2001 was mainly attributable to reductions in flight scheduling and to reduced passenger load factors, following the September 11th terrorist attacks. However, passenger levels have climbed back to pre-9/11—rates, and, with airlines struggling financially the last few years, service factors and flights have been trimmed, causing service numbers to decline recently (Rhoades and Waguespack, 1998, 2000a, 2000b, 2004, 2008 forthcoming).

The focus of both airline service quality systems, the SDI and AQR, are on US airlines, because of the availability of data. The data exists in a format to allow the development of such service quality systems, due to the operational and financial reporting requirements that US carriers must legally comply with. At this time, while the Association of European Airlines presents the “AEA Customer Report” on the association’s website (www.aea.be), the data presented does not exactly match the information available from the US Department of Transportation, and only allows some basic comparisons in service quality issues between US and EU airlines (see Waguespack, Tiernan and Rhoades, 2006). Furthermore, the AEA Consumer Report does not include all EU carriers, as major carriers (ex: Virgin Atlantic, Aer Lingus) as well as many of the major low-cost carriers (ex: Ryanair and easyJet) have opted out of reporting operational data in the AEA Consumer Report.

While the systems developed by both teams of researchers have remained stable, the data presented in the Air Travel Consumer Report have not. The data tables under some of the subsections have been extended over time to include further statistics on issues such as delays by airport or listings of the flights having the worse on-time percentage. Additionally, the number of airlines included in the report has changed over time, and it has not remained steady. With new airlines starting service and growing to merit inclusion (i.e. JetBlue), airlines going out of business (i.e. TWA) or mergers (i.e. US Airways and America West) the number of airlines included in the report has fluctuated over time.

Besides the additional reporting on the original factors and changes in the number of airlines being reported on, new sections have been added over the years to the Air Travel Consumer Report. Recently, in July 2005, new sections in the report have included sections on issues related to (1) Customer Service Reports to the Department of Homeland Security as provided by the Transportation Security Administration and (2) Airline reports to DOT of incidents involving the loss, injury or death of animals during air transport. Both of those new sections were mandated by Congressional acts to be included with the report. News reports have picked up on these changes in the Air Travel Consumer Report, and have presented some of these findings in the press, as part of recent issues concerning service quality issues (McCartney, 2004; Levin & Frank, 2007).

Cancellations and the Air Travel Consumer Report

Cancellations first appeared in the Air Travel Consumer Report in the April 2000 report with the inclusion of “Table 8: Overall Number and Percentage of Flight Cancellations by Carrier” that reported the February 2000 cancellations for the ten major airlines included in the report at that time. For the next few months, little would change about the formatting of table 8, with just the major airlines at that time listed, and the number of

cancellations per month presented. However, ongoing changes in the air transport system would bring a change to the manner in which data was reported.

The summer of 2000 and the wide variety of airline service issues that arose that year provide an easy and recognizable point for the impetus for the inclusion of data about the causes of cancellations into the Air Travel Consumer Report. Examining the data from past SDI research shows that the year 2000 has some of the highest SDI rates until that time (Rhoades and Waguespack, 2004). The summer of 2000 saw many problems, such as weather and labor strife throughout the air transportation system that brought attention to the issue of cancellations, and to their impact on passengers (Gregory 2000). At the same time, as these reports were ongoing in the press, the DOT was actively responding to past events, and the DOT Inspector General issued the Interim Report on Airline Customer Service Commitment in July of 2000 with one section that purposely discussed flight delays and cancellations (US DOT, report AV-2000-102). Concerning cancellations, on page 20 of the Interim Report, the Inspector General notes “we found the airlines have made a clear and substantial effort to communicate delays and cancellations, but the information being communicated is frequently inaccurate, incomplete or unreliable.” Additionally, the report goes on to state (page 20) that “some airlines repeatedly blamed their delay or cancellation entirely on FAA’s air traffic control system when, in fact, the delay was due to severe weather or an Airline schedule irregularity (mechanical problems with the aircraft or flight crew shortages).”

Meanwhile, with these factors at work, and the ongoing statutory responsibility to report on air carrier quality of services, the Department of Transportation on December 27, 2001 issued in the Federal Register proposed rules for “Reporting the Causes of Airline Delays and Cancellations (Volume 66, Number 248).” Reflecting the work of the Air Carrier On-Time Reporting Advisory Committee, the rule proposed criteria for reporting the cause of cancellations. Among the stated goals that this proposal hoped to accomplish were:

“By requiring air carriers to report the cause of delays and cancellations, we hope to address two important air transportation issues: (1) identify the causes of flight delays and cancellations for future corrective action and (2) alleviate some of the frustration and anger that airline passengers have expressed concerning delayed and cancelled flights (page 66835).”

The original notice makes it quite clear that the major airlines at that time were to start reporting on the causes of cancellations immediately. However, it would not be until November 25, 2002 when a “Final Rule” statement appeared in the Federal Register (Volume 67, Number 277) that the date for the official implementation of the procedure to report the causes of cancellations was to be effective June 1, 2003. Soon after, the first data tables reporting the causes for cancellations appeared in the December 2003 Air Travel Consumer Report. Starting in the December 2003 report, “Table 9: Flight Causation Data, by Airline and Category” and “Table 10: Flight Causation Data, Graphical Representation” appeared.

Complaint Category	Com #	Sub-Cat	Com #	Sub-Cat	Com #	Sub-Cat	Com #	Sub-Cat
	2003		2004		2005		2006	
Flight Problems	1,260		1,746		2,234		2,162	
Cancellations		416		617		901		832
Delays		419		442		530		475
Misconnections		208		290		383		453
Baggage	1,080		1,428		2,035		1,936	
Res./Tktg./Boarding	880		931		989		1,007	
Customer Service	695		888		942		1,019	
Complaint Totals	5,983		7,477		8,741		8,321	

Table One – Top Complaint Categories 2003-2006 Air Travel Consumer Report

Service Disquality Index - SDI

To compute the SDI, data from the Air Travel Consumer Report (1987-2007) is utilized. The Air Travel Consumer Report, produced by the US Department of Transportation, was first published in 1987, and, as noted above, has undergone a number of changes over the years. The SDI, as first derived by the authors in 1998 (Rhodes, Waguespack and Truedt, 1998), has been used over the years to measure service quality issues after the events of 9/11 (Rhoades and Waguespack, 2004), and to examine other airline industry segments (Rhoades and Waguespack, 2000b).

The index score derived in the SDI represents the sum of the following data: the percentage of late flights, total number of consumer complaints, total number of involuntary denied boardings, and total number of mishandled baggage reports divided by total yearly departures for a particular airline. In a real sense, this rate is a measure of disquality and can be interpreted as the number of quality problems per departure. As noted by one airline commentator, the data from the report provides different measures of reliability and performance, not overall quality (Perkins, 2007). Using the formulation of the SDI as structured by the researchers, one could postulate that the SDI represents the likelihood of a service failure based on past performance.

This Study

As noted, while the Air Travel Consumer Report has changed, the SDI has not. With the issue of cancellations now having been in the report for several years, and as news stories on cancellations continue to make national and international news (Higgins, 2006; Sloan, 2007), the authors believe that it is now time to include this measure in the index. It is not that cancellations were not addressed in the SDI, but the issue was addressed only tangentially through the complaint measures. If one examines table 1, the leading complaint category over the four years of this

study is “Flight Problems” and the largest complaint sub-category under this issue has been cancellations, almost double the other sub-categories reported the last two years. However, compared to the way the other issues in the SDI are addressed directly with actual occurrences represented, this was, at best, a very minimal method to have cancellations as a factor in the SDI. For this study, the authors examine the relationship between

cancellations and the SDI for the years 2003 through 2006.

For this study, we begin with presenting the original SDI numbers by year for the US major airlines in the Air Travel Consumer Report in table 2. The SDI rates for all the airlines have obviously risen over the past four years. There were lower load factors as well as a lower number of departures after the events of 9/11, as fewer people flew and as airlines trimmed schedules accordingly, and this has lowered the SDI at first. However, as air traffic has resumed nearing pre-9/11 levels, the SDI for the major airlines are climbing once more, as it did before in 1998-2000.

The next table, table 3, displays the yearly cancellation rates for the airlines. This number was derived by totaling the number of cancellations for the year and dividing by departures. While trends are harder to discern with these numbers than the SDI, one notable issue is the low number of cancellations for the years shown for JetBlue during this time, as a stated operational aspect of the airline at the time was to not cancel flights, if at all possible. Also noteworthy is Continental’s low rate, which may speak well for the airline as Continental was one of the few legacy carriers during this time that avoided bankruptcy and reached profitability.

To begin the investigation of cancellations and the possible impact on the SDI, the first analysis completed is to simply correlate the original formulation of the SDI with the airline cancellation rate over the four years studied (correlating the data in table 2 and table 3). No expectation or hypotheses are put forth in the exploratory research. One supposition could be the expectation of a positive correlation between cancellations and the SDI, as it may seem that airlines having service difficulties may well have more cancellations. However, if a policy of the

airline is to attempt to fly the schedule as presented and to not cancel flights, though this may mean delays and late flights increase, cancellations will be minimized, and, therefore, a negative correlation may occur. One would need to know the policy and operational strategy of the individual airline management to therefore make a hypothesis that would be airline-bound.

Airline	SDI 03	Rank 03	SDI 04	Rank 04	SDI 05	Rank 05	SDI 06	Rank 06
Airtran	0.2461	2	0.2260	2	0.3038	1	0.4129	1
Alaska	0.1988	1	0.3030	4	0.4650	7	0.5956	6
American	0.3858	8	0.4357	9	0.5818	9	0.7364	8
America West	0.3372	7	0.4166	8	0.4566	5		
Continental	0.2873	5	0.2942	3	0.4046	3	0.5469	5
Delta	0.4549	11	0.6100	11	0.8167	11	0.9130	9
JetBlue	0.4416	10	0.3972	6	0.5356	8	0.5360	4
Northwest	0.2842	4	0.3628	5	0.4490	4	0.5040	2
Southwest	0.2797	3	0.1491	1	0.3759	2	0.5320	3
United	0.3981	9	0.4117	7	0.4617	6	0.6858	7
USAirways	0.3096	6	0.4547	10	0.7740	10	1.3565	10

Table Two – Original Service Disquality Index by Airline by Year

Airline	Rate 03	Rate 04	Rate 05	Rate 06
Airtran	0.0102	0.0124	0.0125	0.0082
Alaska	0.0193	0.0197	0.0154	0.0159
American	0.0136	0.0148	0.0118	0.0145
AmericaWest	0.0100	0.0153	0.0118	
Continental	0.0006	0.0051	0.0073	0.0049
Delta	0.0099	0.0147	0.0248	0.0150
JetBlue	0.0045	0.0056	0.0079	0.0046
Northwest	0.0111	0.0107	0.0131	0.0113
Southwest	0.0103	0.0103	0.0085	0.0089
United	0.0086	0.0107	0.0115	0.0204
USAirways	0.0145	0.0150	0.0180	0.0175

Table Three - Cancellation rate by departures per year

Airtran -.724	Alaska -.869	American -.035	
Continental .436	Delta .628	JetBlue .347	Northwest .434
Southwest -.775	United .998*	USAirways .793	

Table Four – Correlation of Airline SDI to Cancellation Rate

2003				2004			
Airline	SDI+C	New Rank	Rank Change	Airline	SDI+C	New Rank	Rank Change
Alaska	0.2181	1		Southwest	0.1594	1	
Airtran	0.2562	2		Airtran	0.2384	2	
Southwest	0.2900	3		Continental	0.2993	3	
Continental	0.2937	4	Up 1	Alaska	0.3227	4	
Northwest	0.2953	5	Dw1	Northwest	0.3735	5	
USAirways	0.3241	6	Up 1	Jetblue	0.4028	6	
AmericaWest	0.3473	7	Dw 1	United	0.4223	7	
American	0.3994	8		AmericaWest	0.4320	8	
United	0.4080	9		American	0.4505	9	
Jetblue	0.4461	10		USAirways	0.4697	10	
Delta	0.4648	11		Delta	0.6447	11	

2005				2006			
Airline	SDI+C	New Rank	Rank Change	Airline	SDI+C	New Rank	Rank Change
Airtran	0.3163	1		Airtran	0.4211	1	
Southwest	0.3844	2		Northwest	0.5193	2	
Continental	0.4119	3		Jetblue	0.5406	3	Up 1
Northwest	0.4620	4		Southwest	0.5410	4	Dw 1
AmericaWest	0.4684	5		Continental	0.5517	5	
United	0.4733	6		Alaska	0.6116	6	
Alaska	0.4805	7		United	0.7062	7	
Jetblue	0.5434	8		American	0.7509	8	
American	0.5935	9		Delta	0.9280	9	
USAirways	0.7920	10		USAirways	1.3740	10	
Delta	0.8414	11					

Table Five: Revised SDI with Cancellations included

Reviewing the correlations in table 4, only one is found to be significant, which is United Airlines showing a very strong correlation between the airline’s SDI and cancellation rate. This may come as no surprise, considering the issues that have been ongoing for United in bankruptcy, such as labor relations strife and reports about the problems the airline has had to deal with at its main hub, O’Hare International Airport.

Having examined the relationship between the SDI and the cancellation rate, the researchers proceeded to include cancellations in the SDI. While no obvious relations or implications were discovered by the correlations, with the continued focus on cancellations as a critical service factor by consumers and the press (Higgins, 2006; Holland 2007; Sloan 2007), the researchers decided to include the impact of cancellations, and to examine how the SDI rates would change with the inclusion of this service quality factor. To accomplish this task, the monthly cancellations reported in table 8 in the Air Travel Consumer Report for the major airlines were collected and totaled for the year. Unlike some of the other data points in the Air Travel Consumer Report, there is no yearly compilation of the cancellations. The yearly cancellations were added to the current service factors, and were then divided by total departures to create the SDI with Cancellations (SDI+C) presented in table 5.

Overall cancellations have increased the individual airline SDI. When examining the impact on individual airline rank, little movement occurs with the ranks by year for the airlines with cancellations added to the index. Table 6, however, does provide support for the inclusion of cancellations within the SDI, as the average airline industry SDI rate increased per year with cancellations added. The mean differences by year are found to be significant when analyzing this increase by the industry, using a paired t-test. Therefore, while the difference may not appear to be much numerically-wise, the increase in the annual average does demonstrate that the inclusion of cancellations in the SDI has a meaningful impact.

Implications

The results of this study demonstrate that cancellations need to be added to any research effort that wants to use the Air Travel Consumer Report for the measurement of airline service quality. The number of cancellations may pale in comparison to issues such as the number of delayed flights and baggage reports, which overwhelmingly drive the quality measurement systems using data from the report, such as the original formulation of the SDI and the Airline Quality Rating. Cancellations have recently been in the news again, due to such

	2003	2004
Average Change Industry SDI Rate Per Year	0.0109*	0.0140*
	2005	2006
Average Change Industry SDI Rate Per Year	0.0130*	0.0125*

*Significant at .000

Table Six – Average Change in SDI per Year

incidents as the JetBlue meltdown in February 2007 (Sloan, 2007) and proposed hearings into ‘economic cancellations’ by Congress (Holland, 2007). Failure to include cancellations in some form would not accurately reflect the level of service disquality experienced by airline passengers reflected in the data from the Air Travel Consumer Report.

Using cancellations in some form also acknowledges consumer concerns in the research efforts utilizing data from the report. Although the number of cancellations is strictly an operational factor relating to reliability, as has been noted (Perkins, 2007), consumer issues do enter the report through complaints, and the leading complaint sub-category is cancellations. Therefore, adding cancellations in systems that use the report data is supported by both statistical implications found in this research effort, and by the effort of airline travelers who actually participate in the report by filing a complaint with the DOT.

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