Online Appendix to "Quality Disclosure Programs and Internal Organizational Practices: Evidence from Airline Flight Delays"

By SILKE J. FORBES, MARA LEDERMAN AND TREVOR TOMBE

Appendix A: Identifying Reporting Technology at the Aircraft Level

We only have information on the reporting technology that each airline uses beginning in March 1998. We can safely assume that carriers that are manual reporters in 1998 are also manual reporters in prior years because, if their planes do not have ACARS in 1998, they would not have ACARS prior to 1998. For the carriers that use a combination of manual and automatic reporting, we do not know which or how many of their aircraft are equipped with ACARS. Therefore, we develop an approach for identifying specifically which of their aircraft is likely to be reporting manually. We use the same method to verify that carriers that are automatic reporters in 1998 also reported automatically from 1995-1998. Specifically, we identify a manual plane based on whether delays on the flights carried out by this plane are rounded in a way that is similar to how the manual reporters appear to round their delays. We are able to do this because we can track planes in our data by tail number. Thus, for each aircraft in each year of our data, we calculate the fraction of its flights in that year that have a reported arrival delay of exactly zero. We then compare the distribution of this plane-year level variable across airlines which report their on-time data in different ways.

Table A1 below shows the distribution of this variable for the 10 airlines who reported in 1998. The 95th percentile of the distribution of this variable for American Airlines (an automatic reporter) is 0.046 which indicates that only about 1 percent of American's planes arrived with a delay of zero minutes more than 4.6% of the time. Contrast this to America West (a manual reporter): 50% of its planes landed with a reported delay of zero more than 4.7% of the time. Southwest is an outlier with the 50th percentile of its distribution being 11.7%, far higher than any other airline's. Based on this table, **we categorize any plane that has reported delays of zero for more than 5% of its flights in *any* year as a manual plane for *every* year of our sample**. We see this as a conservative approach to identifying manual planes since it classifies a plane as manual based on it meeting the criteria described above in only a single year. Using this approach, we classify 85 of Continental's 441 planes (19%) and 22 of TWA's 241 planes (9%) as manual.

Table A1
Likelihood of a Plane Landing with Exactly Zero Delay (By Carrier, in 1998)

	50th Percentile	75th Percentile	90th Percentile	95th Percentile	99th Percentile	Reporting Status in 1998
Alaska	0.059	0.064	0.069	0.070	0.074	Manual
America West	0.047	0.053	0.058	0.060	0.064	Manual
American	0.034	0.039	0.044	0.046	0.055	Auto
Continental	0.036	0.041	0.047	0.051	0.066	Combo
Delta	0.040	0.049	0.059	0.062	0.067	Combo
Northwest	0.031	0.035	0.040	0.041	0.049	Auto
Southwest	0.117	0.123	0.128	0.130	0.134	Manual
TWA	0.034	0.038	0.044	0.054	0.066	Combo
United	0.039	0.043	0.047	0.050	0.056	Auto
US Airways	0.038	0.042	0.044	0.046	0.051	Auto

Appendix B: "Two-Minute Early" Results

Table B1
Probability of Arriving *Two* Minutes Earlier than Predicted, 1995-2000,
All Reporting Carriers

Dependent Variable	=1 if Flight Arrives Two Minutes Earlier than Predicted
Predicted Delay	
[10,11) min	0.006***
	(0.001)
[11,12) min	0.008***
	(0.001)
[12,13) min	0.011***
	(0.001)
[13,14) min	0.007***
	(0.001)
[14,15) min	0.010***
	(0.001)
[15,16) min	0.013***
	(0.002)
[16,17) min	0.048***
	(0.002)
[17,18) min	0.012***
	(0.002)
[18,19) min	0.005**
	(0.002)
[19,20) min	0.012***
	(0.002)
[20,21) min	0.014***
	(0.002)
[21,22) min	0.010***
	(0.002)
[22,23) min	0.016***
	(0.002)
[23,24) min	0.005**
	(0.002)
[24,25) min	0.016***
	(0.002)
≥25 min	0.015***
	(0.001)
P-Values from Hypothesis Tests of Equality of Coefficients (two-tailed)	
Bin16=Bin12	0.00
Bin16=Bin18	0.00
Bin16=Bin25	0.00
Prob(2 min early) in group	0.08

Notes: Standard errors are in parentheses and clustered at the level of the arrival airport-day. Coefficients represent the change in the probability of a flight arriving two minutes earlier than predicted relative to flights with predicted delay less than 10 minutes. The regression contains 3,326,681 observations. ** significant at 1%. * significant at 5%. + significant at 10%.

Table B2
Probability of Arriving *Two* Minutes Earlier than Predicted, 1995-2000
Carrier-Specific Estimates

Carrier	Coefficient on [16,17) Bin	Prob(2 min early)	# (%) Flights in [16,17) Bin	Reporting Technology	Bonus Program During 1995-2000
American	0.018** (0.006)	0.10	3,013 (0.80%)	Automatic	N
Alaska	0.049*** (0.010)	0.08	1,195 (1.2%)	Manual	N
Continental	0.120*** (0.009)	0.10	2,213 (0.84%)	Combination	Y
Delta	0.026*** (0.004)	0.10	6,312 (1.1%)	Combination	N
America West	0.058*** (0.009)	0.10	1,492 (1.1%)	Manual	N
Northwest	0.024*** (0.006)	0.10	2,675 (0.79%)	Automatic	N
TWA	0.119*** (0.011)	0.10	1,485 (0.84%)	Combination	Y
United	0.013** (0.005)	0.09	4,421 (0.91%)	Automatic	N
US Airways	0.012** (0.005)	0.09	4,437 (0.95%)	Automatic	N
Southwest	0.137*** (0.006)	0.03	3,603 (0.68%)	Manual	N

Notes: The second column of the table shows the coefficient on the [16,17) bin for each airline. The coefficient represents the change in the probability of arriving one minute earlier than predicted for flights with predicted delay between 16 and 17 minutes, relative to flights with predicted delay less than 10 minutes. The third column shows the fraction of each airline's flights that arrive two minutes earlier than predicted. The fourth column shows the # (%) of each airline's flights that are predicted to arrive between 16 and 17 minutes late. The regression contains 3,326,681 observations. ** significant at 1%. * significant at 5%. [+] significant at 10%.

Table B3
Probability of Arriving Exactly *Two* Minutes Earlier than Predicted, 2002-2008
Carriers that Switch Reporting Technology

Dependent Variable	=1 if Flight Arrives Two Minutes Earlier than Predicted			
	America West	**Alaska**	**Southwest**	
			Manual Period	**Automatic Period**
Predicted Delay				
[12,13) min	0.005	-0.003	0.078***	0.006
	(0.008)	(0.006)	(0.004)	(0.004)
[13,14) min	0.015	0.009	-0.021***	0.001
	(0.008)	(0.006)	(0.002)	(0.004)
[14,15) min	0.039***	0.012	0.004	0.006
	(0.009)	(0.007)	(0.003)	(0.004)
[15,16) min	0.016	-0.007	0.007*	0.007
	(0.009)	(0.006)	(0.003)	(0.004)
[16,17) min	0.022*	0.005	0.074***	0.004
	(0.010)	(0.007)	(0.005)	(0.004)
[17,18) min	0.036***	-0.003	0.052***	0.004
	(0.010)	(0.007)	(0.004)	(0.004)
[18,19) min	0.020	0.003	-0.021***	0.014**
	(0.010)	(0.007)	(0.002)	(0.005)
.....				
≥25 min	0.022***	0.005**	0.005***	0.006***
	(0.003)	(0.002)	(0.001)	(0.001)

Notes: Standard errors are in parentheses and clustered at the level of the arrival airport-day. Columns display select coefficients from a single regression that includes carrier-arrival airport-day fixed effects and arrival hour and hub controls. Coefficients represent the change in the probability of a flight arriving two minutes earlier than predicted, relative to flights with predicted delay less than 10 minutes. The regression contains 2,904,668 observations. ** significant at 1%. * significant at 5%. + significant at 10%.

Table B4
Probability of Arriving *Two* Minutes Earlier than Predicted, 1995-2000
Combination Reporters, Variation in Bonus Programs

Dependent Variable	=1 if Flight Arrives Two Minutes Earlier than Predicted							
	Continental		**TWA pre-Bonus**		**TWA post-Bonus**		**Delta**	
	Manual	**Automatic**	**Manual**	**Automatic**	**Manual**	**Automatic**	**Manual**	**Automatic**
Predicted Delay								
[12,13) min	0.036***	0.024***	-0.008	-0.001	0.017	0.017***	0.022***	0.005**
	(0.006)	(0.003)	(0.020)	(0.006)	(0.013)	(0.004)	(0.003)	(0.002)
[13,14) min	0.028***	0.028***	0.023	-0.001	0.008	0.027***	0.018***	0.005**
	(0.006)	(0.003)	(0.022)	(0.007)	(0.014)	(0.004)	(0.003)	(0.002)
[14,15) min	0.036***	0.042***	-0.020	0.006	0.037*	0.037***	0.020***	0.010***
	(0.007)	(0.004)	(0.021)	(0.008)	(0.016)	(0.005)	(0.003)	(0.002)
[15,16) min	0.058***	0.059***	0.014	-0.004	0.080***	0.064***	0.018***	0.013***
	(0.007)	(0.004)	(0.027)	(0.007)	(0.018)	(0.006)	(0.003)	(0.002)
[16,17) min	0.156***	0.104***	0.051	0.022**	0.229***	0.119***	0.045***	0.018***
	(0.010)	(0.005)	(0.029)	(0.008)	(0.023)	(0.006)	(0.003)	(0.002)
[17,18) min	0.022**	0.023***	0.039	0.013	-0.009	0.006	0.024***	0.010***
	(0.007)	(0.004)	(0.027)	(0.008)	(0.016)	(0.005)	(0.003)	(0.002)
[18,19) min	0.006	0.018***	-0.000	0.001	-0.010	0.001	0.012***	0.009***
	(0.007)	(0.004)	(0.027)	(0.008)	(0.017)	(0.005)	(0.003)	(0.002)
⋯⋯								
≥25 min	0.030***	0.022***	0.027**	0.019***	0.025***	0.023***	0.029***	0.021***
	(0.002)	(0.001)	(0.009)	(0.003)	(0.005)	(0.002)	(0.001)	(0.001)
P-Values from Hypothesis Tests of Equality of Coefficients (two tailed)								
Bin16=Bin12	0.00	0.00	0.10	0.03	0.00	0.00	0.00	0.00
Bin16=Bin18	0.00	0.00	0.20	0.06	0.00	0.00	0.00	0.01
Bin16=Bin25	0.00	0.00	0.44	0.77	0.00	0.00	0.00	0.17
Prob(2 min early)	0.10	0.10	0.11	0.10	0.10	0.10	0.10	0.09

Notes: Standard errors are in parentheses and clustered at the level of the arrival airport-day. Columns display select coefficients from a single regression that includes carrier-arrival airport-day fixed effects and arrival hour and hub controls. Coefficients represent the change in the probability of a flight arriving two minutes earlier than predicted relative to flights with predicted delay of less than 10 minutes. The regression includes flights by Delta, Continental and TWA on every other day between 1995 and 2000 for a total of 4,485,758 observations. ** significant at 1%. * significant at 5%. [+] significant at 10%.

<h3 style="text-align:center">Table B5</h3>
<h3 style="text-align:center">Probability of Arriving Exactly Two Minutes Earlier than Predicted</h3>
<h3 style="text-align:center">Introduction of Later Bonus Programs</h3>

Dependent Variable	=1 if Flight Arrives Two Minutes Earlier than Predicted					
	American Airlines		**US Airways**		**United Airlines**	
	Pre-Bonus	**Post-Bonus**	**Pre-Bonus**	**Post-Bonus**	**Pre-Bonus**	**Post Bonus**
Predicted Delay						
[12,13) min	0.010**	0.012***	0.011*	0.004	-0.012*	0.005
	(0.004)	(0.002)	(0.004)	(0.002)	(0.005)	(0.005)
[13,14) min	0.017***	0.010***	0.003	0.007**	0.007	0.005
	(0.004)	(0.003)	(0.004)	(0.002)	(0.005)	(0.005)
[14,15) min	0.014***	0.019***	0.017***	0.005	-0.002	0.004
	(0.004)	(0.003)	(0.005)	(0.003)	(0.005)	(0.005)
[15,16) min	0.022***	0.021***	0.011*	0.002	-0.010	0.004
	(0.004)	(0.003)	(0.005)	(0.003)	(0.005)	(0.005)
[16,17) min	0.030***	0.029***	0.004	0.003	-0.004	0.002
	(0.004)	(0.003)	(0.005)	(0.003)	(0.005)	(0.006)
[17,18) min	0.019***	0.009**	0.015**	0.007*	0.015*	0.006
	(0.005)	(0.003)	(0.005)	(0.003)	(0.006)	(0.006)
[18,19) min	0.010*	0.009**	0.003	0.009**	0.005	0.006
	(0.005)	(0.003)	(0.005)	(0.003)	(0.006)	(0.006)
≥25 min	0.011***	0.010***	0.016***	0.013***	0.010***	0.013***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N (Years included in sample)	2,777,448 (2002-2005)		2,101,260 (2004-2007)		1,087,605 (2008-2010)	
Prob(2 min early)	0.10	0.10	0.10	0.11	0.11	0.10
P-Values from Hypothesis Tests of Equality of Coefficients (two tailed tests)						
Bin16=Bin12	0.00	0.00	0.31	0.94	0.26	0.73
Bin16=Bin18	0.00	0.00	0.87	0.14	0.30	0.65
Bin16=Bin25	0.00	0.00	0.01	0.00	0.02	0.07

Notes: Standard errors are in parentheses and clustered at the level of the arrival airport-day. Separate regressions are run for each of the carriers in the table. The regressions include arrival airport-day fixed effects and arrival hour and hub controls. Coefficients represent the change in the probability of a flight arriving two minutes earlier than predicted, relative to flights with predicted delay less than 10 minutes. ** significant at 1%. * significant at 5%. [+] significant at 10%.