

TECHNION – Israel Institute of Technology
The William Davidson Faculty of Industrial Engineering & Management

Center for Service Enterprise Engineering (SEE)
<http://ie.technion.ac.il/Labs/Serveng/>



Banking Call Centers

EDA via SEEStat 3.0

to **Reproduce**

“Data-Stories about (Im)Patient Customers in Tele-Queues”

A. Mandelbaum, S. Zeltyn

http://ie.technion.ac.il/serveng/References/Impatience_data_stories/impatience_data_stories_rev2.pdf

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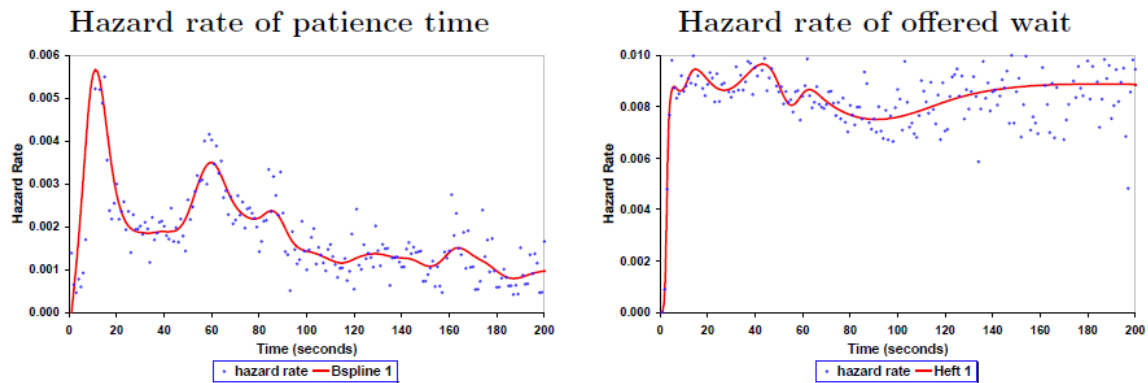
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Table 2: Source data for Figures produced via SEEStat

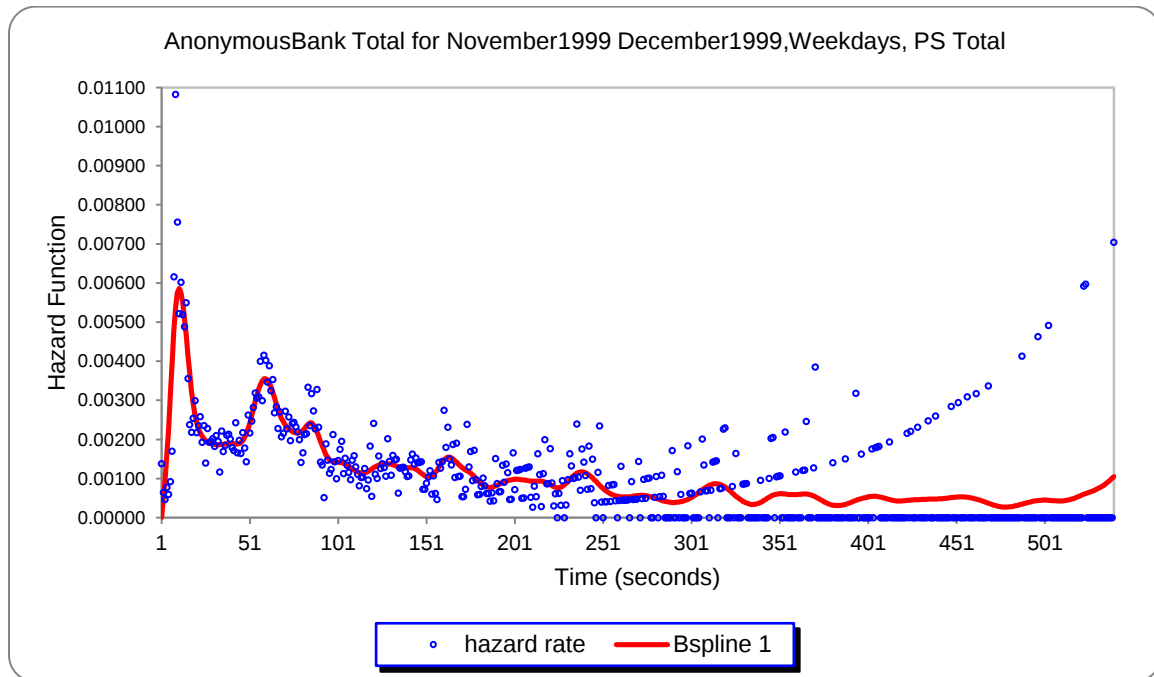
Figure	Data set	Time period	Customer type	Performance measures
Figure 1	AnonymousBank	Nov-Dec 1999 Weekdays	PS (Retail)	Patience and offered wait Estimate of hazard rate
Figure 2	USBank	Jan-Oct 2003 Weekdays	Retail	Patience and offered wait Estimate of hazard rate
Figure 4	ILBank	Nov 24, 2008	Private	Waiting time Histograms for full and truncated (10 sec) distributions
Figure 5	ILBank	Nov 24, 2008	Private	Waiting time Distributions fit; data truncated at 10 sec
Figure 6	ILBank	Nov 24, 2008	Private	Waiting time Tail distribution fit for generalized Pareto
Figure 7	ILBank	Nov 24, 2008	Private	Waiting time Fitting mixtures by proportions grid algorithm
Figure 9	USBank	Tue and Wed on Oct 2001	Telesales	Arrivals to queue
Figure 10	USBank	Tue and Wed on Oct 2001	Telesales	Agents on line
Figure 11	USBank	Oct 9-10, 2001	Telesales	Unhandled proportion, Average wait time
Figure 12	USBank	Dec 2002, Weekdays	Quick&Reilly	Wait time (handled, unhandled)
Figure 13	USBank	Dec 2002, Weekdays	Quick&Reilly	Wait time (handled, unhandled) survival curve estimate; polynomial smoothing spline

Figure 1: Patience and offered wait in an Israeli call center



SEESat selection		
Study	<i>SmallAnonymousBank</i>	
Model	<i>Survival Analysis, Survival Curve Estimate</i>	
Tabs	Censored time	<i>Handled Wait time</i>
	Failure time	<i>Unhandled Wait time</i>
	Options	Select Smoothing: <i>Advanced ,Cubic Smoothing Spline</i> Click <i>Parameters</i> . Close Smoothing Algorithms ☐ Hazard Estimation with Flexible Tails ☐ Kernel Regression ☒ Cubic Smoothing Spline ☐ Polynomial Smoothing Spline ☐ Local Polynomial Regression Fitting ☐ Friedman's SuperSmoother ☐ Hazard Estimation using Kernel-based methods <- Previous Parameters Next-> Smoothing Parameter: <i>Selected = 0.4</i> Click <i>Apply</i> . Cubic Smoothing Spline Smoothing Parameter ☐ Automatic ☒ Selected 0 0.4 1 Smoothing Method smoothing parameter optimizes generalized Apply Cancel Tables: <i>Summary statistics</i> <i>Smoothing</i> Charts: <i>Hazards</i>
	Select Categories	service <i>PS</i> , priority <i>Total</i>
Dates	<i>Dates totals only, November 1999, December 1999, Weekdays</i>	

Original SEEStat chart:



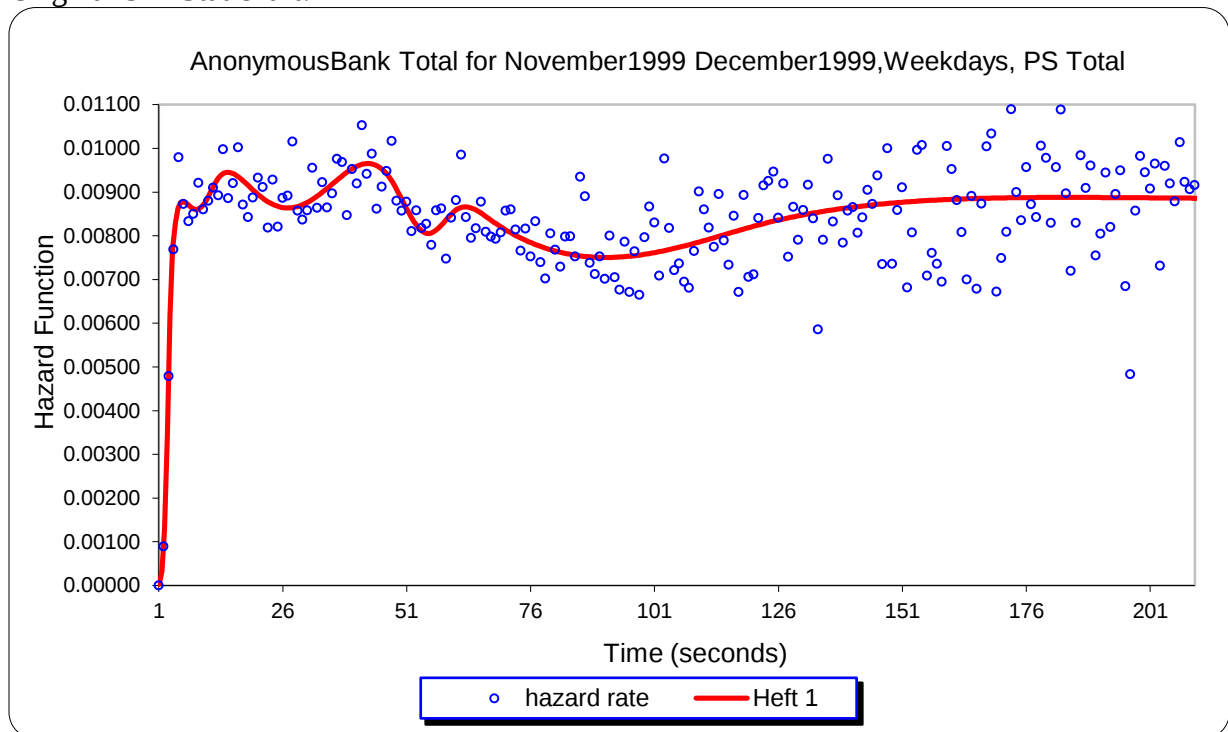
Original SEEStat table:

Summary				
of the Number of Censored and Uncensored Values				
Failure Time: Unhandled Wait Time				
Censored Time: Handled Wait Time				
group	Number of cases	Failed	Censored	Percent Censored
PS Total	32557	6353	26204	80.49

Smoothing Hazard		
id	name	parameters
Bspline 1	Cubic Smoothing Spline	Smoothing Parameter = 0.40 Smoothing Method: smoothing parameter optimizes generalized cross-validation criterion

	SEESat selection	
Study	<i>SmallAnonymousBank</i>	
Model	<i>Survival Analysis, Survival Curve Estimate</i>	
Tabs	Censored time	<i>Unhandled Wait time</i>
	Failure time	<i>Handled Wait time</i>
	Options	<u>Hazard/Density Charts Options:</u> set limits <i>Use Display Range</i> <u>Select Smoothing:</u> <i>Default</i> Hazard/Density Charts Options set limits ☒ Use Display Range ☐ Automatic ☐ Bin Events Select Smoothing ☐ None ☒ Default ☐ Advanced <u>Tables:</u> <i>Summary statistics</i> <i>Smoothing</i> <u>Charts:</u> <i>Hazards</i>
	Select Categories	service <i>PS</i> , priority <i>Total</i>
	X Properties	<u>Range to Display:</u> Upper Limit <i>03:30</i>
Dates	<i>Dates totals only, November 1999, December 1999, Weekdays</i>	

Original SEESat chart:

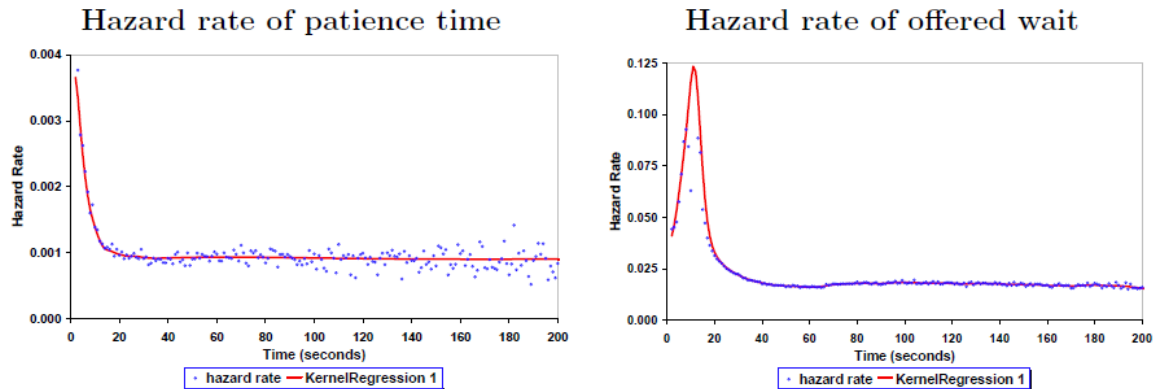


Original SEEStat table:

<i>Summary</i>				
<i>of the Number of Censored and Uncensored Values</i>				
<i>Failure Time: Handled Wait Time</i>				
<i>Censored Time: Unhandled Wait Time</i>				
<i>group</i>	<i>Number of cases</i>	<i>Failed</i>	<i>Censored</i>	<i>Percent Censored</i>
PS Total	32557	26204	6353	19.51

<i>Smoothing Hazard</i>		
<i>id</i>	<i>name</i>	<i>parameters</i>
Heft 1	Hazard Estimation with Flexible Tails	

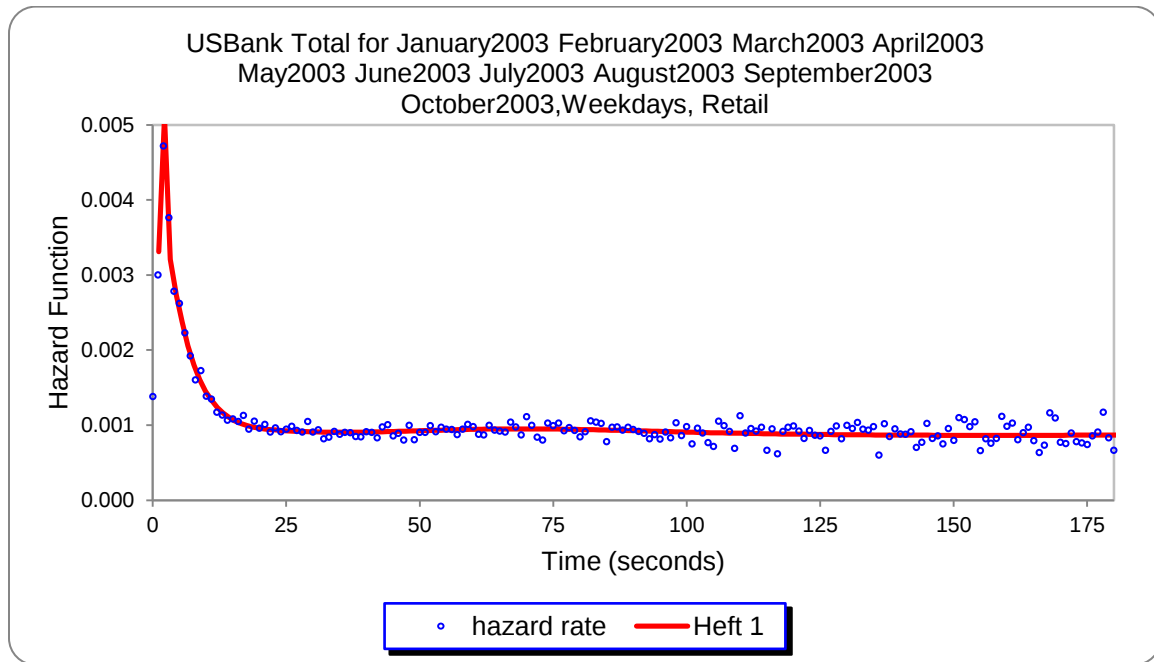
Figure 2: Patience and offered wait in a U.S. call center



SEESat selection		
Study	USBank	
Model	Survival Analysis, Survival Curve Estimate	
Tabs	Censored time	Wait time (handled)
	Failure time	Wait time (unhandled)
	Options	<u>Hazard/Density Charts Options:</u> set limits <i>Use Display Range</i> <u>Select Smoothing:</u> <i>Default</i> <u>Tables:</u> <i>Summary statistics</i> <i>Smoothing</i> <u>Charts:</u> <i>Hazards</i>
	Select Categories	service <i>Retail</i>
	X Properties	<u>Range to Display:</u> Upper Limit <i>03:00</i>
Dates	<i>Dates totals only, January 2003- October 2003, Weekdays</i>	

Note: The US Bank database was updated in June 2012. As a consequence of this update, HEFT smoothing turned out more appropriate, when compared against the Kernel Regression used in the above 2 graphs of Figure 2. Thus, in the sequel, the reproduced graphs use HEFT.
Original SEESat chart:

Original SEEStat chart:



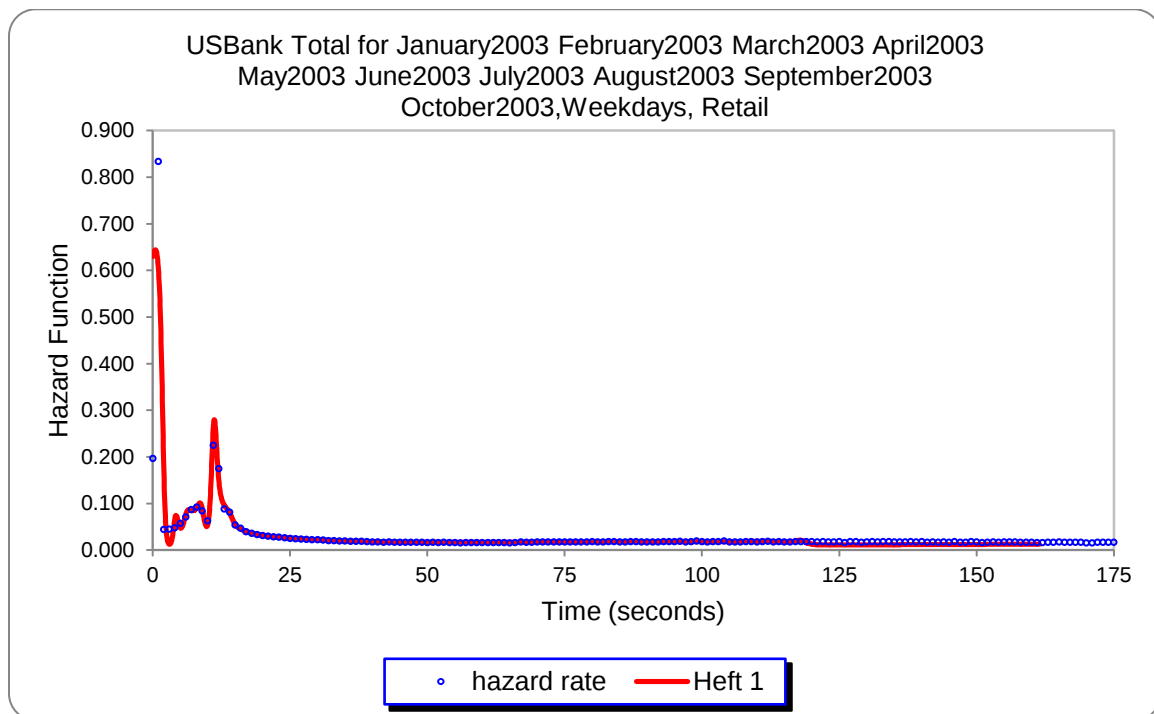
Original SEEStat table:

Summary				
of the Number of Censored and Uncensored Values				
Failure Time: Wait time(unhandled)				
Censored Time: Wait time(handled)				
group	Number of cases	Failed	Censored	Percent Censored
Retail	7010518	99938	6910580	98.57

Smoothing Hazard		
id	name	parameters
Heft 1	Hazard Estimation with Flexible Tails	

SEESat selection		
Study	USBank	
Model	Survival Analysis, Survival Curve Estimate	
Tabs	Censored time	Wait time (unhandled)
	Failure time	Wait time (handled)
	Options	Hazard/Density Charts Options: set limits Use Display Range Select Smoothing: Default Tables: Summary statistics Smoothing Charts: Hazards
	Select Categories	service Retail
	X Properties	Range to Display: Upper Limit 03:00
Dates	Dates totals only, January 2003- October 2003, Weekdays	

Original SEESat chart:

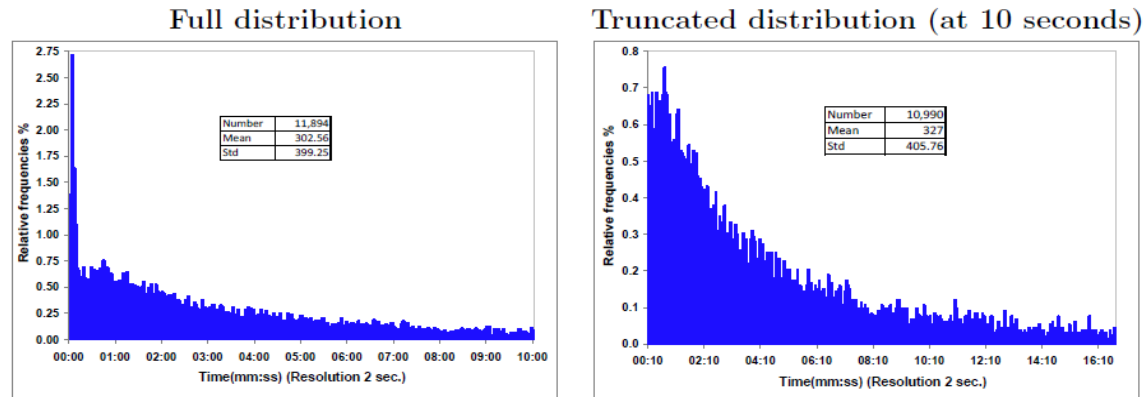


Original SEEStat table:

<i>Summary</i>				
<i>of the Number of Censored and Uncensored Values</i>				
<i>Failure Time: Wait time(handled)</i>				
<i>Censored Time: Wait time(unhandled)</i>				
<i>group</i>	<i>Number of cases</i>	<i>Failed</i>	<i>Censored</i>	<i>Percent Censored</i>
Retail	7010518	6910580	99938	1.43

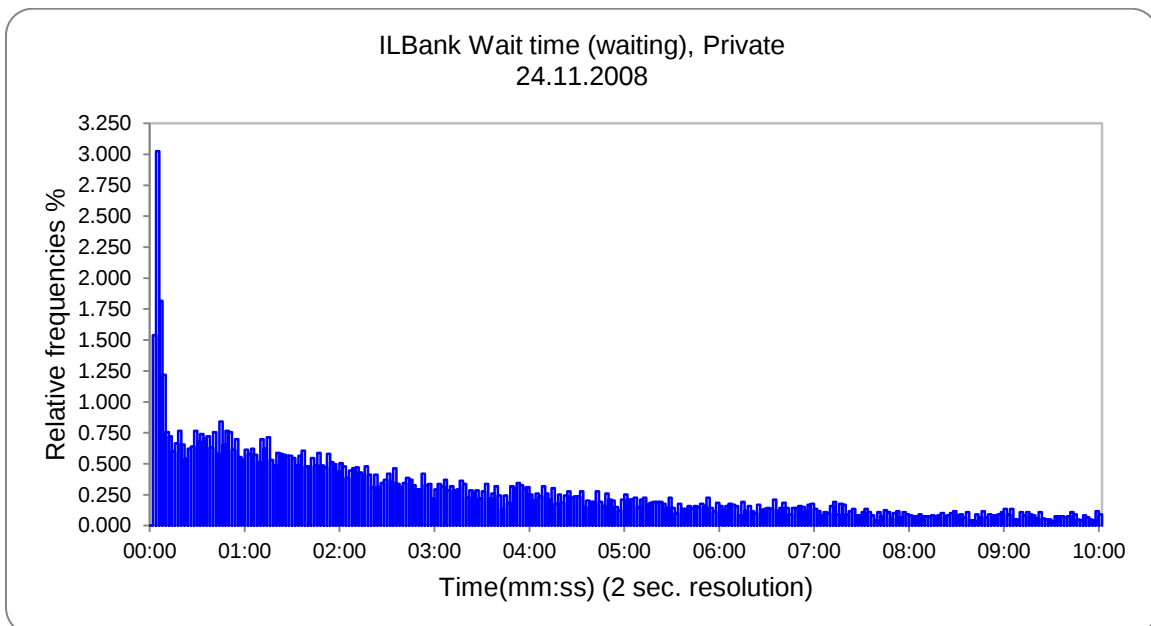
<i>Smoothing Hazard</i>		
<i>id</i>	<i>name</i>	<i>parameters</i>
Heft 1	Hazard Estimation with Flexible Tails	

Figure 4: Financial call center. Patience at a day with no service



SEESat selection		
Study	ILBank	
Model	Distribution, Estimates	
Tabs	Variables	Wait time (waiting)
	Select Categories	service <i>Private</i> , customer type <i>Total</i>
	X Properties	Resolution: 00:02
		Range to Display: Select Upper Limit by <i>Values</i> Low Limit (sec.) <i>Minimal Value</i> Upper Limit(min:sec) <i>10:00</i>
Dates	Individual days, November 24, 2008	

Original SEESat chart:



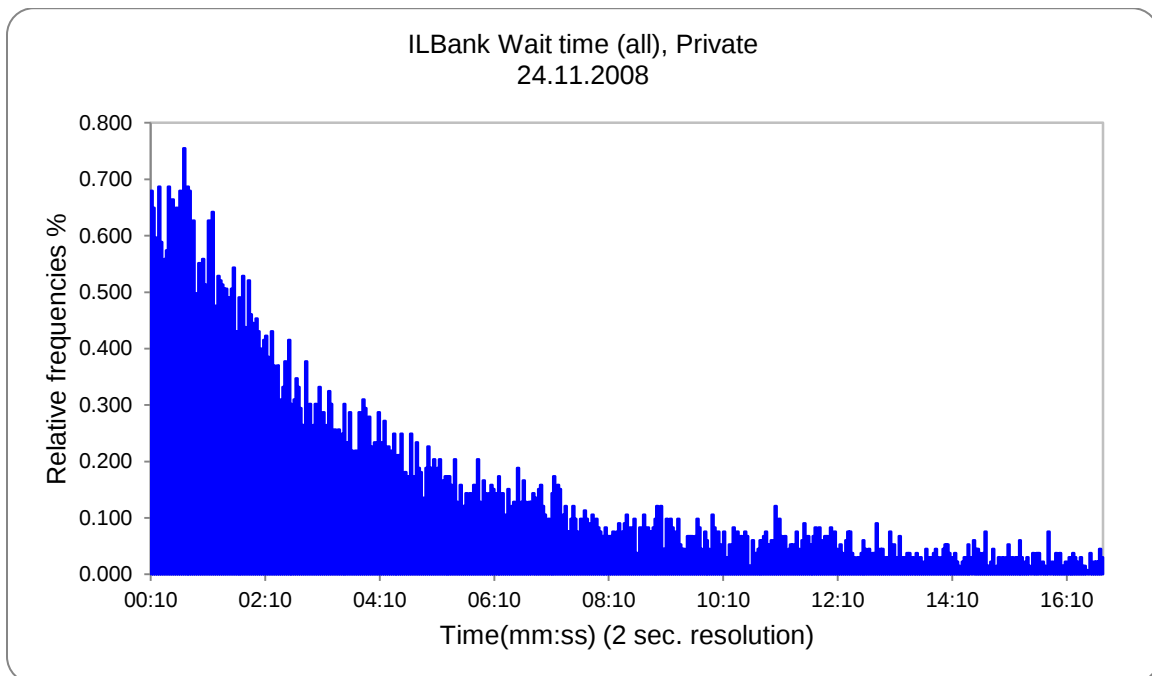
	SEESat selection	
Study	<i>ILBank</i>	
Model	<i>Distribution, Estimates</i>	
Tabs	Variables	<i>Wait time (waiting)</i>
	Options	<i>Numeric Scale</i>
	Select Categories	service <i>Private</i> , customer type <i>Total</i>
	X Properties	Resolution: <i>00:02</i> Range to Display: Select Upper Limit by <i>Values</i> Low Limit (sec.) <i>Minimal Value</i> Upper Limit(min:sec) <i>10:00</i>
Dates	<i>Individual days, November 24, 2008</i>	

Original SEESat table:

Statistics	
	<i>Wait time (waiting)</i>
N	11894
Mean	302.56
Standard Deviation	399.25
Variance	159404
Median	164
Minimum	2
Maximum	3583
Skewness	3.052
Kurtosis	13.12
Standard Error Mean	3.661
Interquartile Range	324
Mean Absolute Deviation	263.61
Median Absolute Deviation(MAD)	127
Coefficient of Variation(CV) (%)	131.96
L-moment 2(half of Gini's Mean Difference)	176.92
L-Skewness	0.448
L-Kurtosis	0.25
Coefficient of L-variation(L-CV) (%) (Gini's Coefficient)	58.47

SEESat selection		
Study	<i>ILBank</i>	
Model	<i>Distribution, Estimates</i>	
Tabs	Variables	<i>Wait time (all)</i>
	Select Categories	service <i>Private</i> , customer type <i>Total</i>
	X Properties	<u>Resolution:</u> <i>00:02</i> <u>Range to Display:</u> Select Upper Limit by <i>Quantiles</i> Low limit <i>10</i> Upper Quantile(%) <i>95.0</i> <u>Range to Compute:</u> Select Upper Limit by <i>Quantiles</i> Low limit <i>10</i> Upper Quantile(%) <i>100.0</i>
Dates	<i>Individual days, November 24, 2008</i>	

Original SEESat chart:

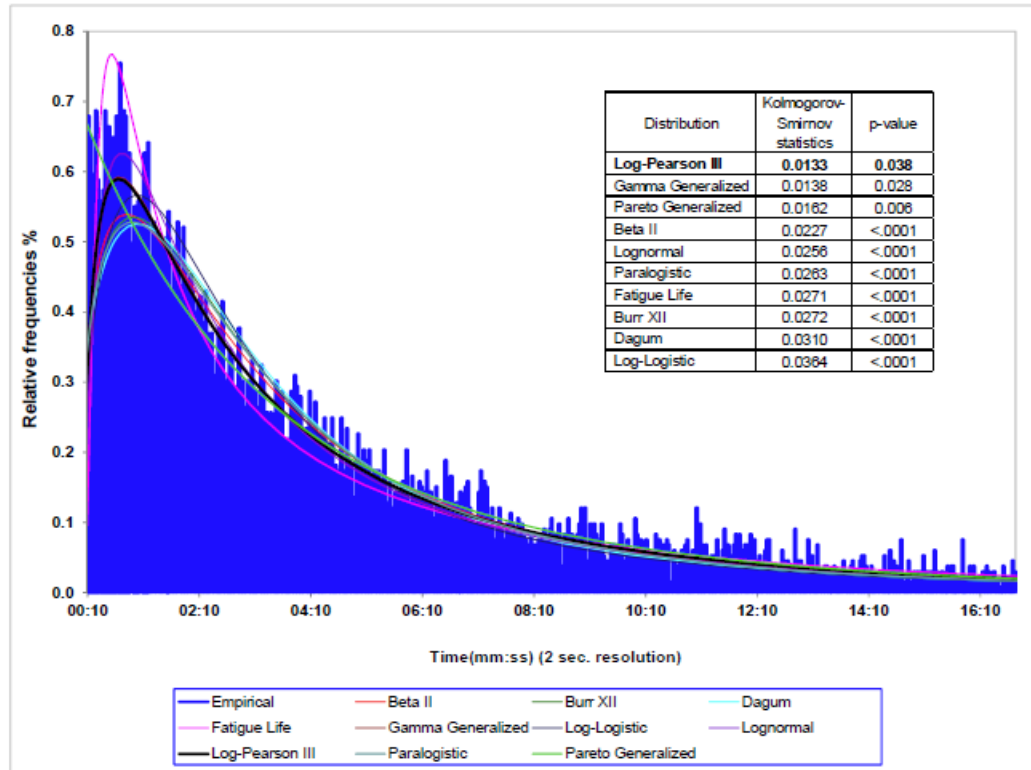


Original SEESat table:

Statistics	
	Wait time (all)
N	10990
Mean	327.02
Standard Deviation	405.76
Variance	164643
Median	187
Minimum	10
Maximum	3583
Skewness	2.999
Kurtosis	12.58
Standard Error Mean	3.871
Interquartile Range	331
Mean Absolute Deviation	269.11
Median Absolute Deviation(MAD)	131
Coefficient of Variation(CV) (%)	124.08
L-moment 2(half of Gini's Mean Difference)	180.74
L-Skewness	0.444
L-Kurtosis	0.248
Coefficient of L-variation(L-CV) (%) (Gini's Coefficient)	55.27

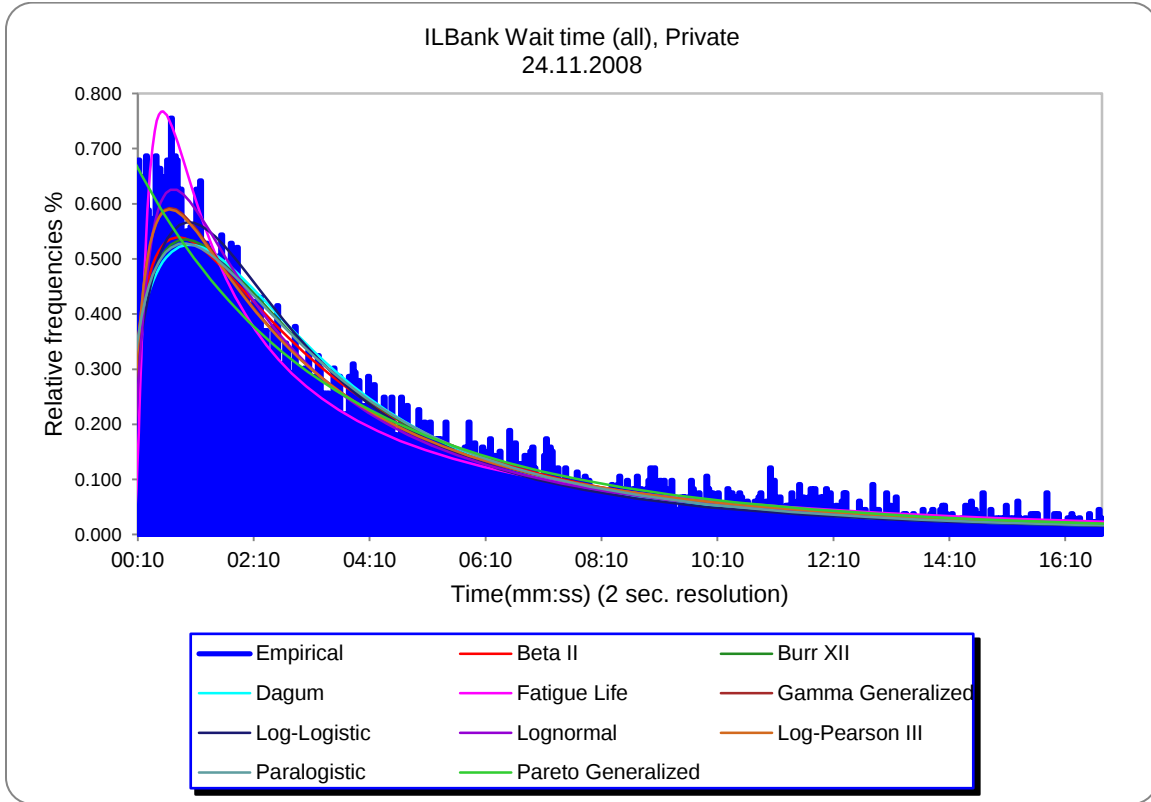
	SEESat selection	
Study	<i>ILBank</i>	
Model	<i>Distribution, Estimates</i>	
Tabs	Variables	<i>Wait time (all)</i>
	Options	<i>Numeric Scale</i>
	Select Categories	service <i>Private</i> , customer type <i>Total</i>
	X Properties	<u>Resolution:</u> <i>00:02</i> <u>Range to Display:</u> Select Upper Limit by <i>Quantiles</i> Low limit <i>10</i> Upper Quantile(%) <i>95.0</i> <u>Range to Compute:</u> Select Upper Limit by <i>Quantiles</i> Low limit <i>10</i> Upper Quantile(%) <i>100.0</i>
Dates	<i>Individual days, November 24, 2008</i>	

Figure 5: Patience at a day with no service. Fitting various distributions



	SEESat selection	
Study	<i>ILBank</i>	
Model	<i>Distribution, Fitting</i>	
Tabs	Variables	<i>Wait time (all)</i>
	Options	Distributions: <i>Beta II, Burr XII, Dagum, Fatigue Life, Gamma Generalized, Log-Logistic, Lognormal, Log-Pearson III, Paralogistic, Pareto Generalized</i>
	Select Categories	service <i>Private</i> , customer type <i>Total</i>
	X Properties	Resolution: <i>00:02</i> Range to Display: Select Upper Limit by <i>Quantiles</i> Low limit <i>10</i> Upper Quantile(%) <i>95.0</i> Range to Compute: Select Upper Limit by <i>Quantiles</i> Low limit <i>10</i> Upper Quantile(%) <i>100.0</i>
Dates	<i>Individual days, November 24, 2008</i>	

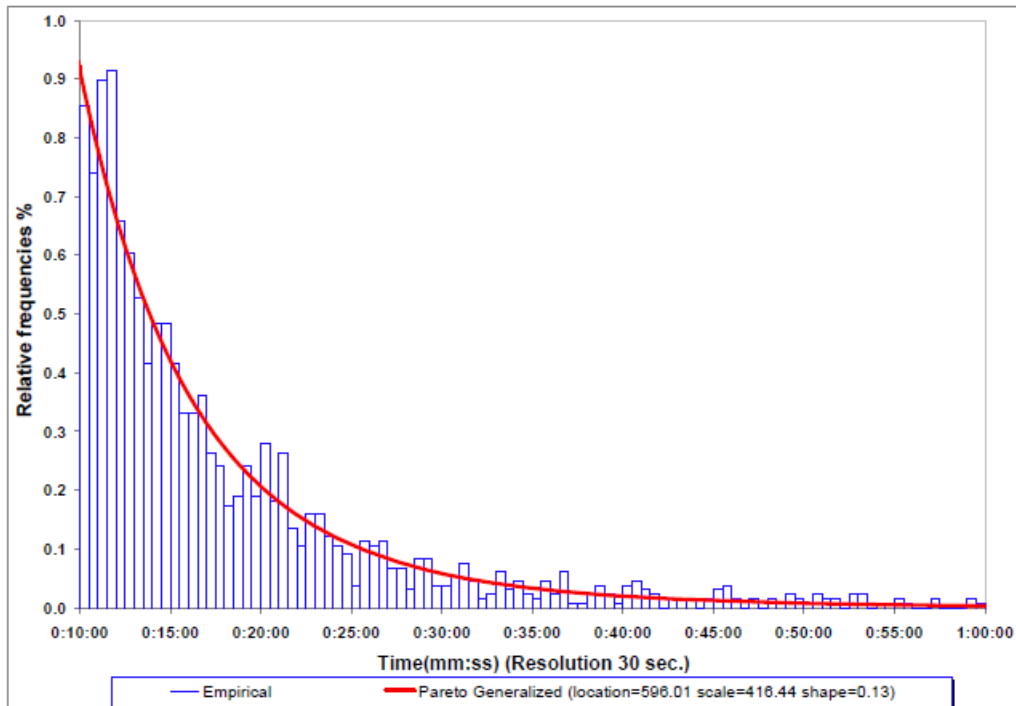
Original SEEStat chart:



Original SEEStat table:

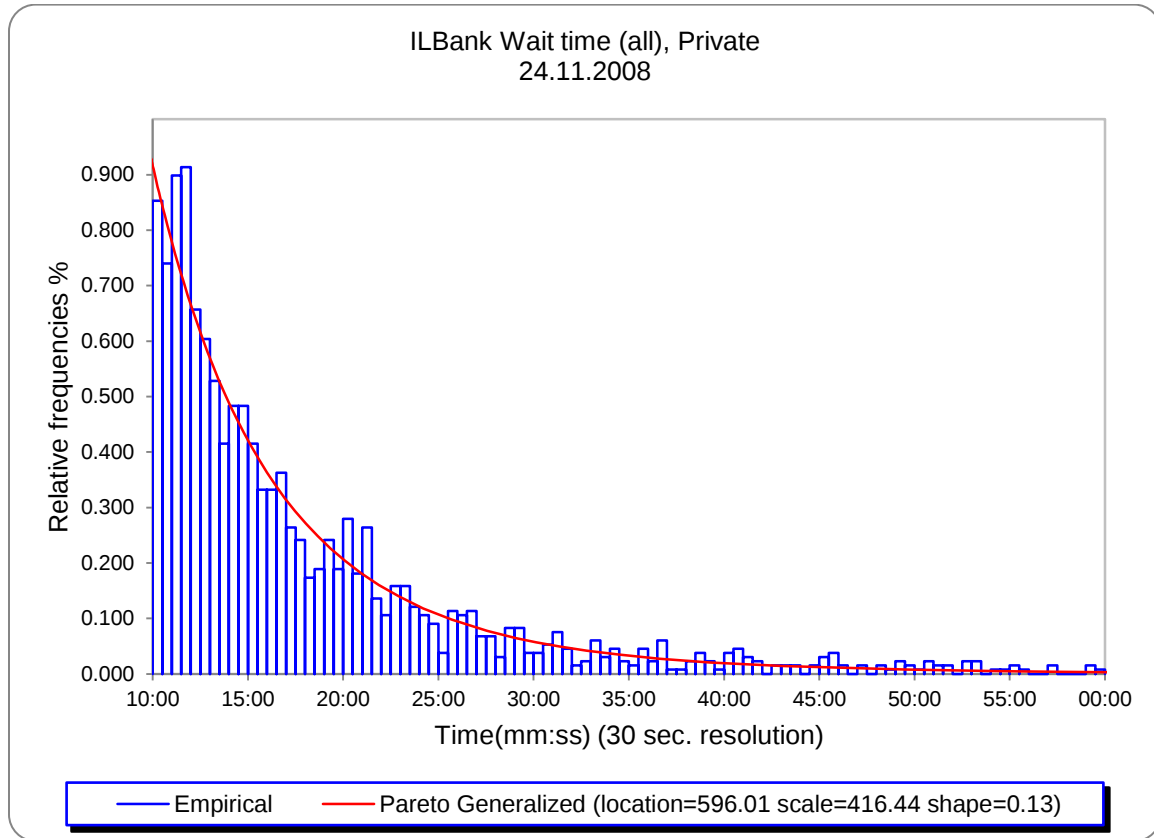
Distribution	Goodness-of-Fit Tests									
	Residuals Std	Kolmogorov-Smirnov		Cramer-von Mises		Anderson-Darling		Chi-Square		
		Statistic	p Value	Statistic	p Value	Statistic	p Value	Statistic	DF	p Value
Beta II	0.0138389	0.0227213	<.0001	2.1041970	<.0001	14.80	<.0001	115.64	25	<.0001
Burr XII	0.0173251	0.0272196	<.0001	3.2978470	<.0001	22.79	<.0001	184.91	25	<.0001
Dagum	0.0196674	0.0309607	<.0001	4.2498640	<.0001	28.81	<.0001	233.33	25	<.0001
Fatigue Life	0.0144033	0.0270774	<.0001	2.2795330	<.0001	15.06	<.0001	103.39	26	<.0001
Gamma Generalized	0.0074302	0.0137651	0.028	0.6065752	0.021	4.83	0.003	53.60	25	0.00075
Log-Logistic	0.0211257	0.0363637	<.0001	4.9038880	<.0001	32.19	<.0001	252.32	26	<.0001
Lognormal	0.0127685	0.0256285	<.0001	1.7914260	<.0001	12.19	<.0001	89.60	26	<.0001
Log-Pearson III	0.0068665	0.0132677	0.038	0.5180382	0.036	4.33	0.006	50.23	25	0.00200
Paralogistic	0.0169003	0.0263057	<.0001	3.1383940	<.0001	21.75	<.0001	173.83	26	<.0001
Pareto Generalized	0.0075012	0.0161677	0.006	0.6182244	0.020	6.64	<.0001	52.49	25	0.00104

Figure 6: Patience at a day with no service. Fitting distribution tail



SEESat selection		
Study	<i>ILBank</i>	
Model	<i>Distribution, Fitting</i>	
Tabs	Variables	<i>Wait time (all)</i>
	Options	Distributions: <i>Pareto Generalized</i>
	Select Categories	service <i>Private</i> , customer type <i>Total</i>
	X Properties	Resolution: <i>00:30</i> Range to Display: Select Upper Limit by <i>Quantiles</i> Low limit <i>600</i> Upper Quantile(%) <i>100.0</i> Range to Compute: <i>Use Display Range</i>
Dates	<i>Individual days, November 24, 2008</i>	

Original SEEStat chart:



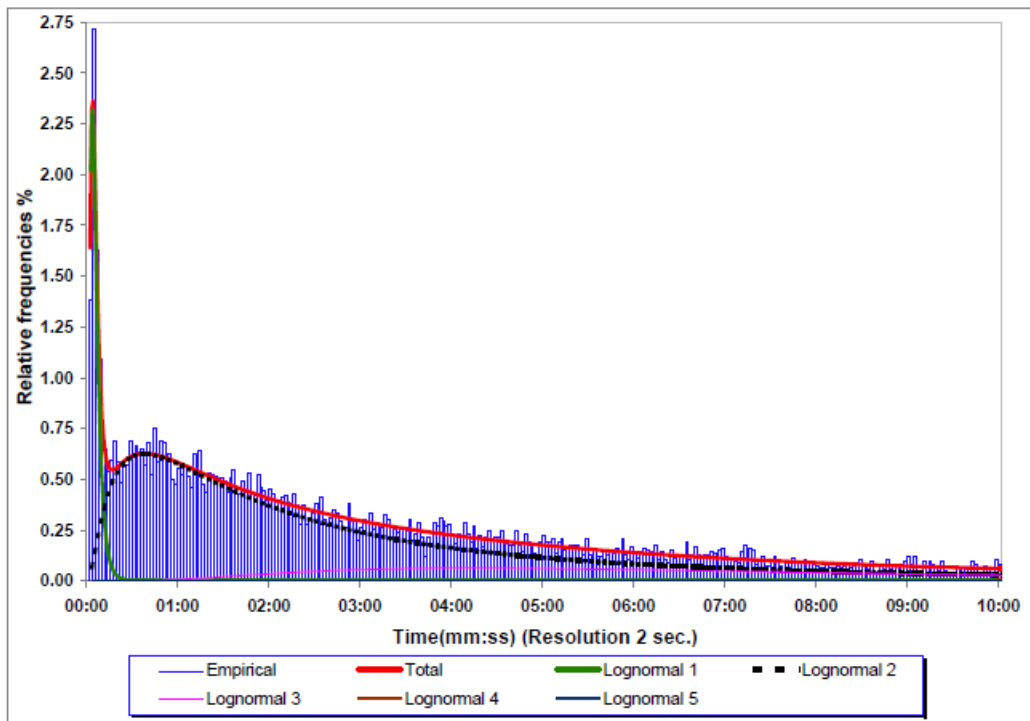
Original SEEStat table:

Parameters for Pareto Generalized Distribution	
Parameter	Estimate
location	596.01
scale	416.44
shape	0.13
mean	1075.2
std	557.77

Goodness-of-Fit Tests for Pareto Generalized Distribution			
Test	Statistic	DF	p Value
Residuals Std	0.0092		
Kolmogorov-Smirnov	0.0214		0.393
Cramer-von Mises	0.1428		0.413
Anderson-Darling	1.4269		0.195
Chi-Square	33.1069	15	0.005

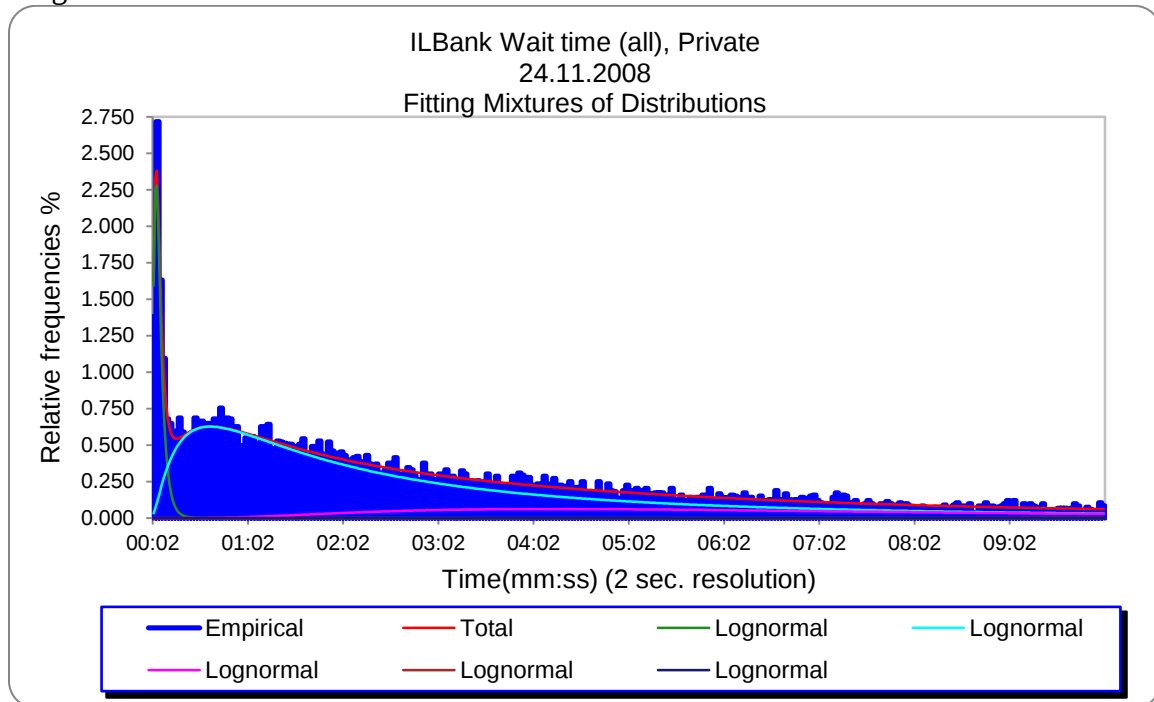
Statistics	
	Wait time (all)
N	1702
Mean	17 min 54 sec
Standard Deviation	8 min 48 sec
Variance	78 min^2
Median	14 min 45 sec
Minimum	10 min
Maximum	59 min 43 sec
Skewness	2.016
Kurtosis	4.389
Standard Error Mean	12 sec
Interquartile Range	8 min 40 sec
Mean Absolute Deviation	6 min 21 sec
Median Absolute Deviation(MAD)	3 min 28 sec
Coefficient of Variation(CV) (%)	49.18
L-moment 2(half of Gini's Mean Difference)	4 min 16 sec
L-Skewness	0.394
L-Kurtosis	0.199
Coefficient of L-variation(L-CV) (%) (Gini's Coefficient)	23.86

Figure 7: Patience at a day with no service. Fitting mixtures



	SEESat selection	
Study	<i>ILBank</i>	
Model	<i>Distribution, Mixture Fitting</i>	
Tabs	Variables	<i>Wait time (all)</i>
	Options	Distributions: <i>Lognormal</i> Number of Components: <i>5</i>
	Select Categories	service <i>Private</i> , customer type <i>Total</i>
	X Properties	Resolution: <i>00:02</i> Range to Display: Select Upper Limit by <i>Values</i> Low Limit (sec.) <i>2</i> Upper Limit(min:sec) <i>10:00</i> Range to Compute: Select Upper Limit by <i>Quantiles</i> Low limit <i>2</i> Upper Quantile(%) <i>100.0</i>
Dates	<i>Individual days, November 24, 2008</i>	

Original SEEStat chart:



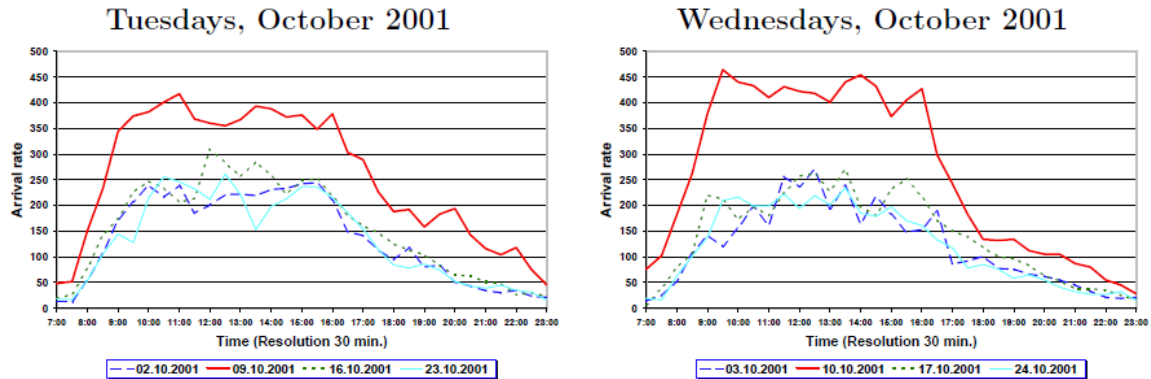
Original SEEStat table:

Statistics	
	Wait time (all)
N	11894
Mean	5 min 2 sec
Standard Deviation	6 min 39 sec
Variance	44 min ²
Median	2 min 44 sec
Minimum	2 sec
Maximum	59 min 43 sec
Skewness	3.052
Kurtosis	13.12
Standard Error Mean	3 sec
Interquartile Range	5 min 24 sec
Mean Absolute Deviation	4 min 23 sec
Median Absolute Deviation(MAD)	2 min 7 sec
Coefficient of Variation(CV) (%)	131.96
L-moment 2(half of Gini's Mean Difference)	2 min 56 sec
L-Skewness	0.448
L-Kurtosis	0.25

Parameter Estimates						
Components	Mixing Proportions (%)	Location	Scale	Shape	Mean	Standard Deviation
1. Lognormal	8.08		1.66704	0.54	6.11	3.525401
2. Lognormal	70.18		4.89873	1.12	251.58	399.2546
3. Lognormal	19.27		6.00851	0.69	514.87	399.2546
4. Lognormal	1.25		6.65447	0.17	787.62	135.3366
5. Lognormal	1.22		7.28795	0.26	1512.66	399.2546

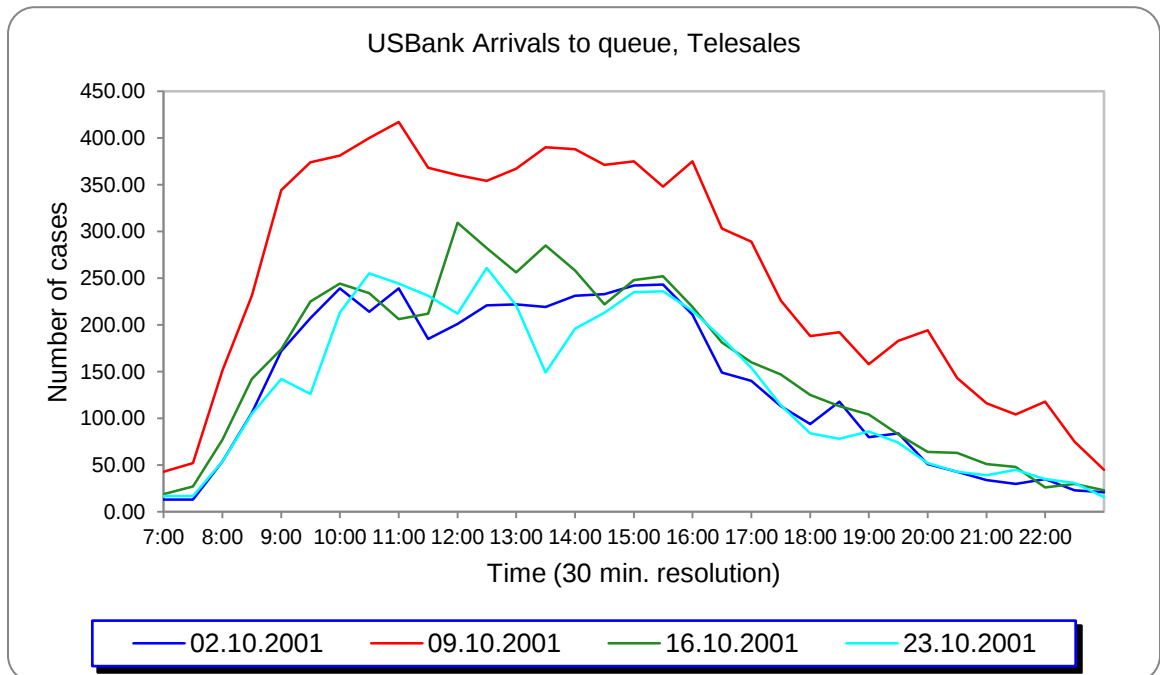
Goodness-of-Fit Tests			
Tests	Statistic	DF	p Value
Residuals Std	0.00248		
Kolmogorov-Smirnov	0.01623		0.0033
Cramer-von Mises	0.07316		0.7333
Andersen-Darling	1.85104		0.1111
Chi-Square	4677.29000	3572	<.0001

Figure 9: US Bank. Arrival rate of Telesales customers



SEESat selection		
Study	USBank	
Model	Time Series, Intraday	
Tabs	Variables	Arrivals to queue
	Select Categories	service Telesales
	X Properties	Resolution: 30:00 Range to Display: Low Limit (hours:min) 07:00 Upper Limit (hours:min) 23:00
Dates	Individual days, October 2, 9, 16, 23, 2001	

Original SEESat chart:

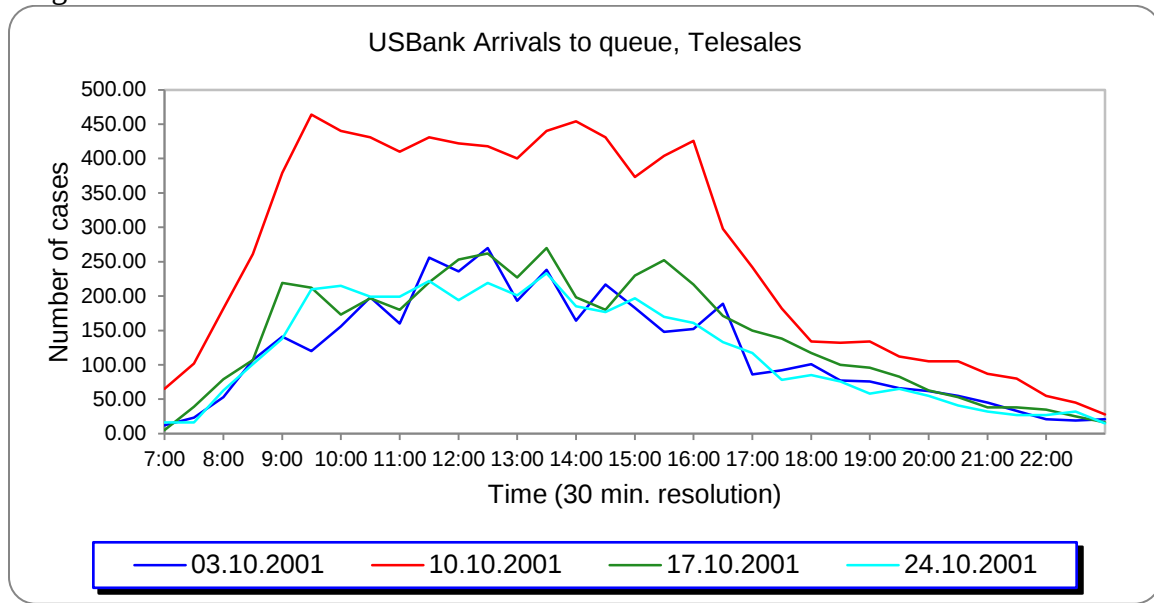


Original SEESat table:

Data				
Time	02.10.2001	09.10.2001	16.10.2001	23.10.2001
07:00	13.00	43.00	19.00	17.00
07:30	13.00	52.00	27.00	17.00
08:00	54.00	151.00	77.00	54.00
08:30	106.00	231.00	142.00	105.00
09:00	172.00	344.00	174.00	142.00
09:30	207.00	374.00	225.00	126.00
10:00	239.00	381.00	244.00	213.00
10:30	214.00	400.00	234.00	255.00
11:00	239.00	417.00	206.00	244.00
11:30	185.00	368.00	212.00	231.00
12:00	201.00	360.00	309.00	212.00
12:30	221.00	354.00	282.00	261.00
13:00	222.00	367.00	256.00	221.00
13:30	219.00	390.00	285.00	149.00
14:00	231.00	388.00	258.00	196.00
14:30	233.00	371.00	222.00	213.00
15:00	242.00	375.00	248.00	235.00
15:30	243.00	348.00	252.00	236.00
16:00	211.00	375.00	219.00	215.00
16:30	149.00	303.00	181.00	186.00
17:00	140.00	289.00	160.00	154.00
17:30	113.00	226.00	147.00	114.00
18:00	94.00	188.00	125.00	84.00
18:30	118.00	192.00	113.00	78.00
19:00	80.00	158.00	104.00	86.00
19:30	84.00	183.00	83.00	74.00
20:00	51.00	194.00	64.00	52.00
20:30	43.00	143.00	63.00	43.00
21:00	34.00	116.00	51.00	39.00
21:30	30.00	104.00	48.00	45.00
22:00	35.00	118.00	26.00	35.00
22:30	23.00	75.00	30.00	31.00
23:00	21.00	45.00	23.00	16.00

SEESat selection		
Study	<i>USBank</i>	
Model	<i>Time Series, Intraday</i>	
Tabs	Variables	<i>Arrivals to queue</i>
	Select Categories	service <i>Telesales</i>
	X Properties	<u>Resolution:</u> <i>30:00</i> <u>Range to Display:</u> Low Limit (hours:min) <i>07:00</i> Upper Limit (hours:min) <i>23:00</i>
Dates		<i>Individual days, October 3, 10, 17, 24, 2001</i>

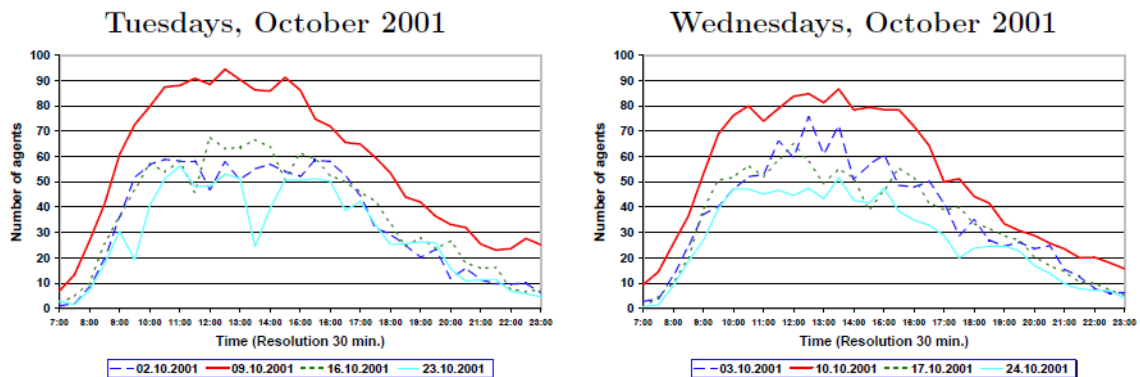
Original SEEStat chart:



Original SEEStat table:

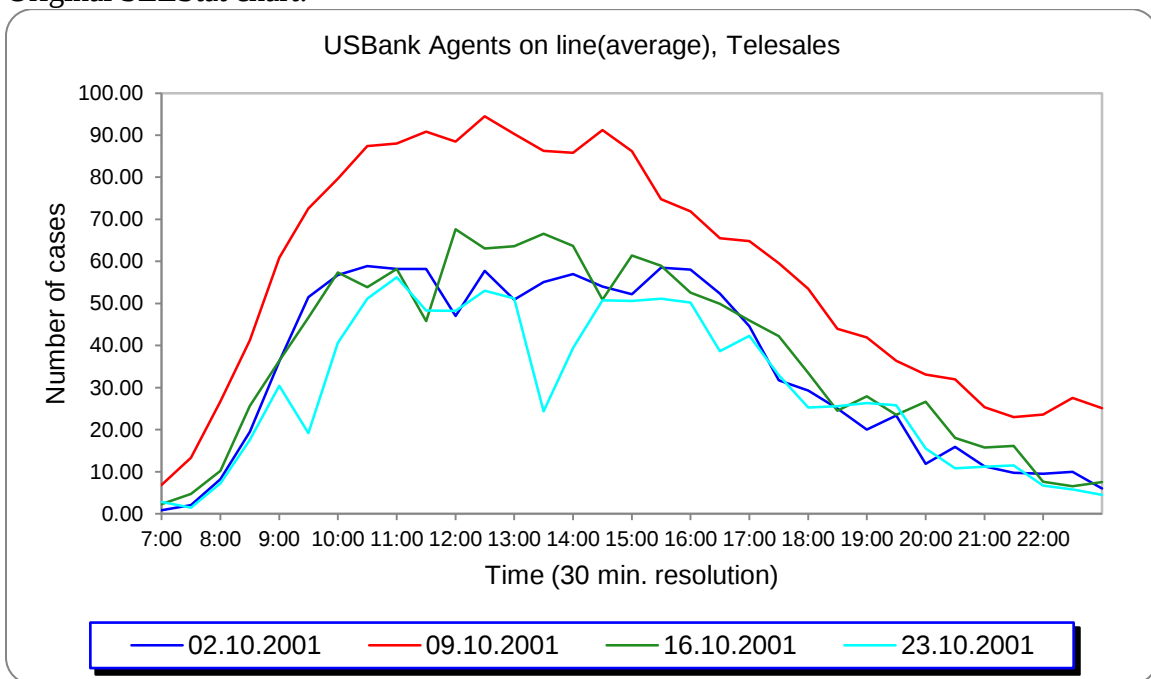
Data				
Time	03.10.2001	10.10.2001	17.10.2001	24.10.2001
07:00	12.00	65.00	5.00	16.00
07:30	23.00	102.00	39.00	16.00
08:00	53.00	182.00	79.00	63.00
08:30	107.00	261.00	107.00	101.00
09:00	141.00	379.00	219.00	138.00
09:30	120.00	464.00	212.00	210.00
10:00	156.00	440.00	173.00	215.00
10:30	198.00	431.00	197.00	199.00
11:00	160.00	410.00	180.00	199.00
11:30	256.00	431.00	220.00	222.00
12:00	236.00	422.00	253.00	194.00
12:30	270.00	418.00	262.00	219.00
13:00	193.00	400.00	227.00	201.00
13:30	238.00	440.00	270.00	233.00
14:00	164.00	454.00	198.00	185.00
14:30	217.00	431.00	180.00	177.00
15:00	183.00	373.00	230.00	197.00
15:30	148.00	404.00	252.00	170.00
16:00	152.00	426.00	217.00	161.00
16:30	189.00	298.00	171.00	133.00
17:00	86.00	242.00	150.00	117.00
17:30	92.00	182.00	138.00	78.00
18:00	101.00	134.00	117.00	85.00
18:30	77.00	132.00	100.00	76.00
19:00	76.00	134.00	96.00	58.00
19:30	66.00	112.00	83.00	65.00
20:00	62.00	105.00	63.00	55.00
20:30	55.00	105.00	53.00	41.00
21:00	45.00	87.00	38.00	32.00
21:30	33.00	80.00	38.00	27.00
22:00	21.00	55.00	35.00	27.00
22:30	19.00	45.00	25.00	32.00
23:00	21.00	28.00	16.00	15.00

Figure 10: US Bank. Telesales customers. Number of agents



SEESat selection		
Study	USBank	
Model	Time Series, Intraday	
Tabs	Variables	Agents on line (average)
	Select Categories	service Telesales
	X Properties	Resolution: 30:00 Range to Display: Low Limit (hours:min) 07:00 Upper Limit (hours:min) 23:00
Dates	Individual days, October 2, 9, 16, 23, 2001	

Original SEESat chart:

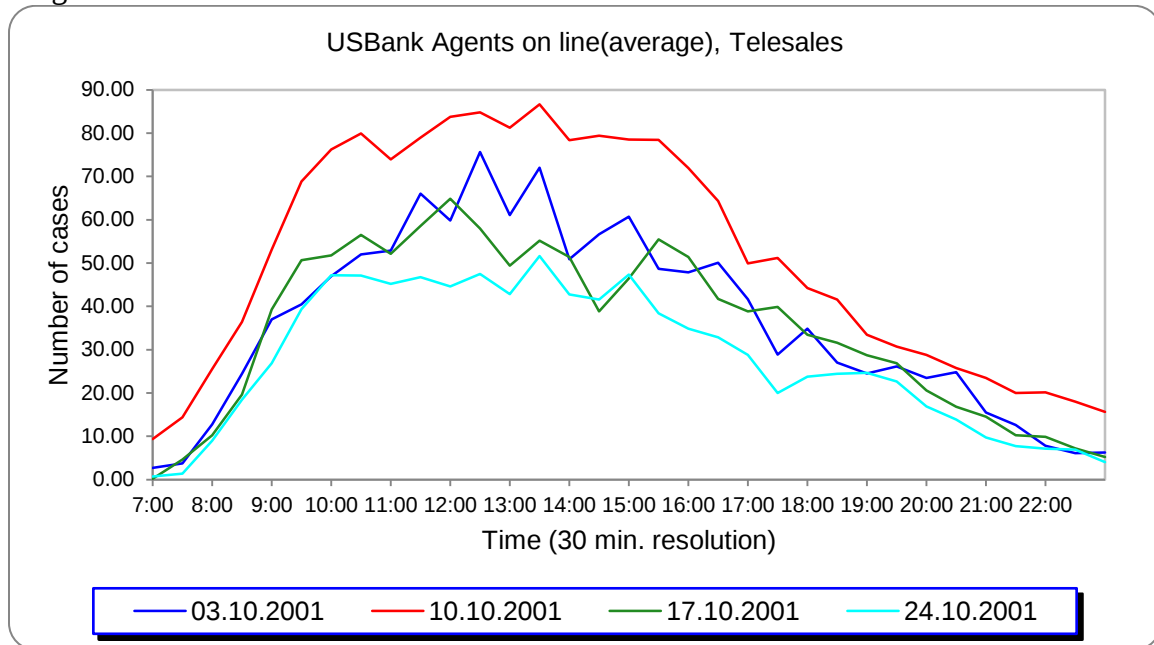


Original SEESat table:

Data				
Time	02.10.2001	09.10.2001	16.10.2001	23.10.2001
07:00	0.89	6.90	2.32	2.87
07:30	2.04	13.30	4.74	1.48
08:00	8.27	26.70	10.20	7.27
08:30	19.50	41.26	25.66	17.57
09:00	36.20	60.86	36.40	30.43
09:30	51.54	72.58	46.66	19.19
10:00	56.79	79.69	57.38	40.61
10:30	58.87	87.44	53.88	51.15
11:00	58.20	88.05	58.24	56.26
11:30	58.20	90.84	45.80	48.30
12:00	46.99	88.49	67.67	48.22
12:30	57.74	94.46	63.07	53.03
13:00	50.90	90.32	63.57	51.19
13:30	55.05	86.27	66.56	24.39
14:00	57.02	85.83	63.70	39.43
14:30	54.03	91.22	50.90	50.73
15:00	52.17	86.22	61.38	50.62
15:30	58.48	74.78	58.96	51.16
16:00	58.03	71.90	52.60	50.20
16:30	52.34	65.53	49.89	38.68
17:00	44.57	64.84	45.96	42.28
17:30	31.76	59.60	42.22	32.97
18:00	29.31	53.47	33.50	25.29
18:30	25.05	43.99	24.53	25.54
19:00	20.03	41.97	27.94	26.32
19:30	23.40	36.38	23.50	25.81
20:00	11.86	33.10	26.64	15.50
20:30	15.93	31.95	18.06	10.79
21:00	11.29	25.34	15.80	11.24
21:30	9.79	23.03	16.16	11.50
22:00	9.56	23.58	7.63	6.72
22:30	9.98	27.58	6.53	5.83
23:00	6.04	25.11	7.53	4.54

SEESat selection		
Study	<i>USBank</i>	
Model	<i>Time Series, Intraday</i>	
Tabs	Variables	<i>Agents on line (average)</i>
	Select Categories	service <i>Telesales</i>
	X Properties	<u>Resolution:</u> <i>30:00</i> <u>Range to Display:</u> Low Limit (hours:min) <i>07:00</i> Upper Limit (hours:min) <i>23:00</i>
Dates	<i>Individual days, October 3, 10, 17, 24, 2001</i>	

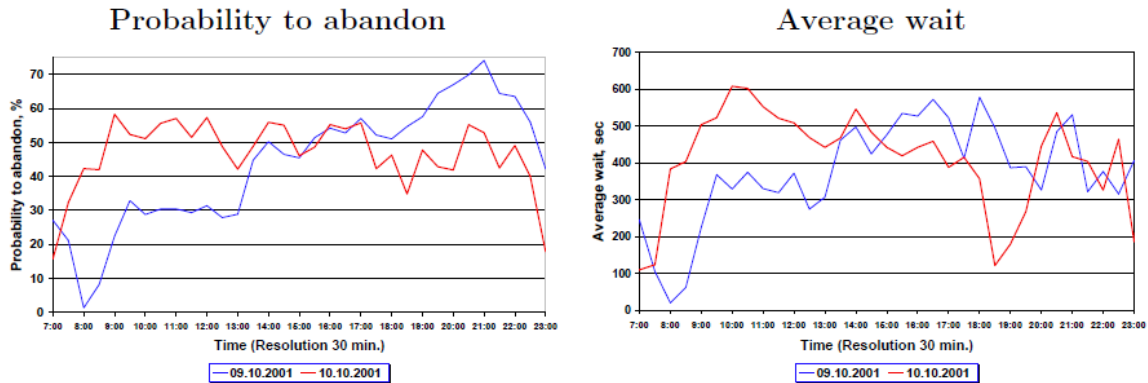
Original SEESat chart:



Original SEESat table:

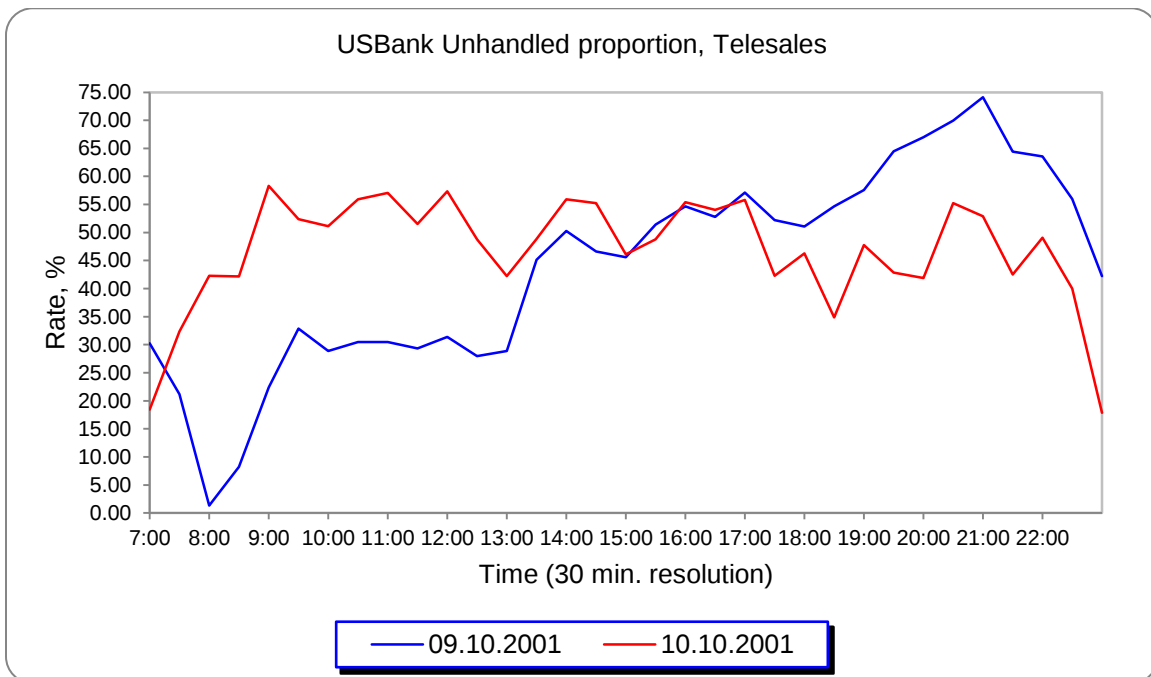
Data				
Time	03.10.2001	10.10.2001	17.10.2001	24.10.2001
07:00	2.71	9.38	0.23	0.69
07:30	3.78	14.35	4.62	1.34
08:00	12.76	25.51	10.22	8.98
08:30	24.45	36.38	19.65	18.45
09:00	36.96	53.06	39.27	26.90
09:30	40.46	68.85	50.62	39.35
10:00	46.93	76.22	51.76	47.21
10:30	51.99	79.94	56.48	47.09
11:00	52.88	73.95	52.14	45.18
11:30	66.00	78.97	58.53	46.71
12:00	59.78	83.75	64.84	44.57
12:30	75.59	84.78	57.97	47.45
13:00	61.08	81.25	49.37	42.83
13:30	72.02	86.63	55.15	51.62
14:00	50.85	78.38	51.43	42.72
14:30	56.67	79.41	38.81	41.59
15:00	60.71	78.50	46.46	47.31
15:30	48.64	78.41	55.46	38.36
16:00	47.88	71.91	51.40	34.82
16:30	50.09	64.34	41.75	32.87
17:00	41.66	49.95	38.85	28.79
17:30	28.86	51.20	39.90	19.98
18:00	34.85	44.21	33.46	23.78
18:30	27.04	41.55	31.60	24.46
19:00	24.51	33.42	28.69	24.62
19:30	26.14	30.68	26.84	22.68
20:00	23.48	28.80	20.56	16.86
20:30	24.78	25.79	16.81	13.88
21:00	15.47	23.45	14.53	9.72
21:30	12.63	20.01	10.26	7.75
22:00	7.80	20.17	9.90	7.14
22:30	6.11	18.02	7.22	6.95
23:00	6.24	15.62	5.21	4.02

Figure 11: US Bank. Performance measures on October 9-10, 2001



	SEESat selection	
Study	USBank	
Model	Time Series, Intraday	
Tabs	Variables	Unhandled proportion
	Select Categories	service Telesales
	X Properties	Resolution: 30:00 Range to Display: Low Limit (hours:min) 07:00 Upper Limit (hours:min) 23:00
Dates	Individual days, October 9, 10, 2001	

Original SEESat chart:

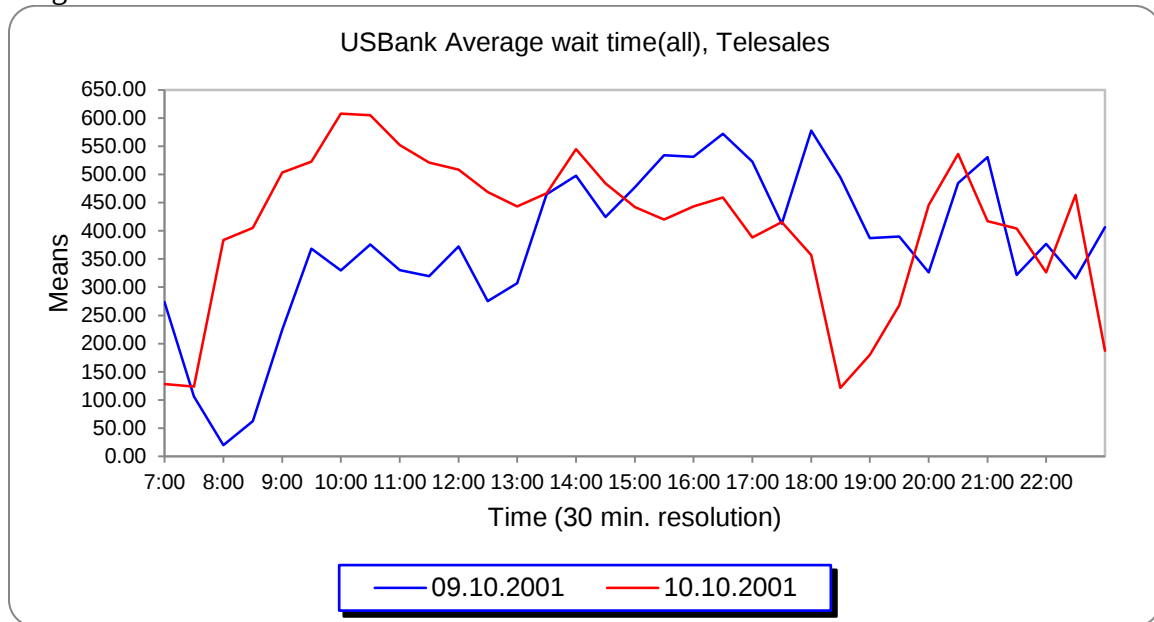


Original SEESat table:

Data		
Time	09.10.2001	10.10.2001
07:00	30.23	18.46
07:30	21.15	32.35
08:00	1.32	42.31
08:30	8.23	42.15
09:00	22.38	58.31
09:30	32.89	52.37
10:00	28.87	51.14
10:30	30.50	55.92
11:00	30.46	57.07
11:30	29.35	51.51
12:00	31.39	57.35
12:30	27.97	48.80
13:00	28.88	42.25
13:30	45.13	48.86
14:00	50.26	55.95
14:30	46.63	55.22
15:00	45.60	46.11
15:30	51.44	48.76
16:00	54.67	55.40
16:30	52.81	54.03
17:00	57.09	55.79
17:30	52.21	42.31
18:00	51.06	46.27
18:30	54.69	34.85
19:00	57.59	47.76
19:30	64.48	42.86
20:00	67.01	41.90
20:30	69.93	55.24
21:00	74.14	52.87
21:30	64.42	42.50
22:00	63.56	49.09
22:30	56.00	40.00
23:00	42.22	17.86

	SEESat selection	
Study	<i>USBank</i>	
Model	<i>Time Series, Intraday</i>	
Tabs	Variables	<i>Average wait time (all)</i>
	Select Categories	service <i>Telesales</i>
	X Properties	<u>Resolution:</u> <i>30:00</i> <u>Range to Display:</u> Low Limit (hours:min) <i>07:00</i> Upper Limit (hours:min) <i>23:00</i>
Dates	<i>Individual days, October 9, 10, 2001</i>	

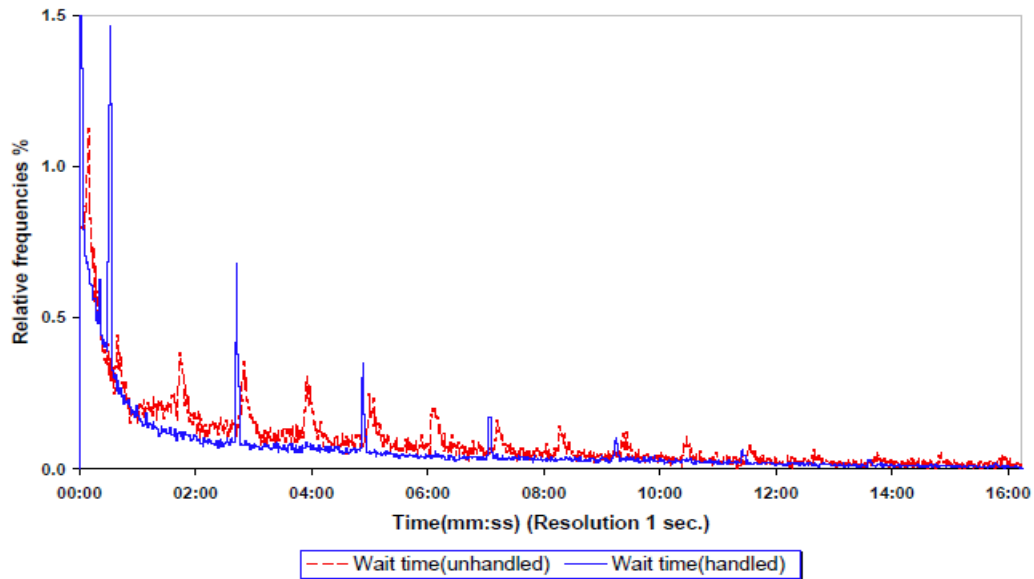
Original SEEStat chart:



Original SEEStat table:

Data		
Time	09.10.2001	10.10.2001
07:00	273.74	128.22
07:30	105.94	123.78
08:00	20.07	383.46
08:30	62.32	405.30
09:00	224.62	503.49
09:30	368.21	522.49
10:00	329.79	607.92
10:30	375.43	604.99
11:00	330.19	552.38
11:30	319.24	521.06
12:00	372.11	508.56
12:30	275.05	468.76
13:00	307.12	443.19
13:30	464.86	466.23
14:00	497.59	544.69
14:30	424.41	484.21
15:00	477.34	442.07
15:30	534.22	419.98
16:00	531.18	443.24
16:30	572.05	458.80
17:00	522.42	387.92
17:30	412.27	415.12
18:00	577.74	357.10
18:30	494.91	121.58
19:00	386.78	179.77
19:30	389.58	267.86
20:00	326.41	445.67
20:30	484.62	536.05
21:00	530.63	416.87
21:30	321.64	403.90
22:00	376.68	326.04
22:30	315.66	463.62
23:00	406.27	187.29

Figure 12: Patience and offered wait in a US bank



SEESat selection		
Study	ILBank	
Model	Distribution, Estimates	
Tabs	Variables	Wait time (unhandled), Wait time (handled)
	Options	Chart type Polygon
	Select Categories	service Quick&Reilly
	X Properties	Resolution: 00:01
Dates	Aggregated days, December, 2002	

Original SEESat chart:

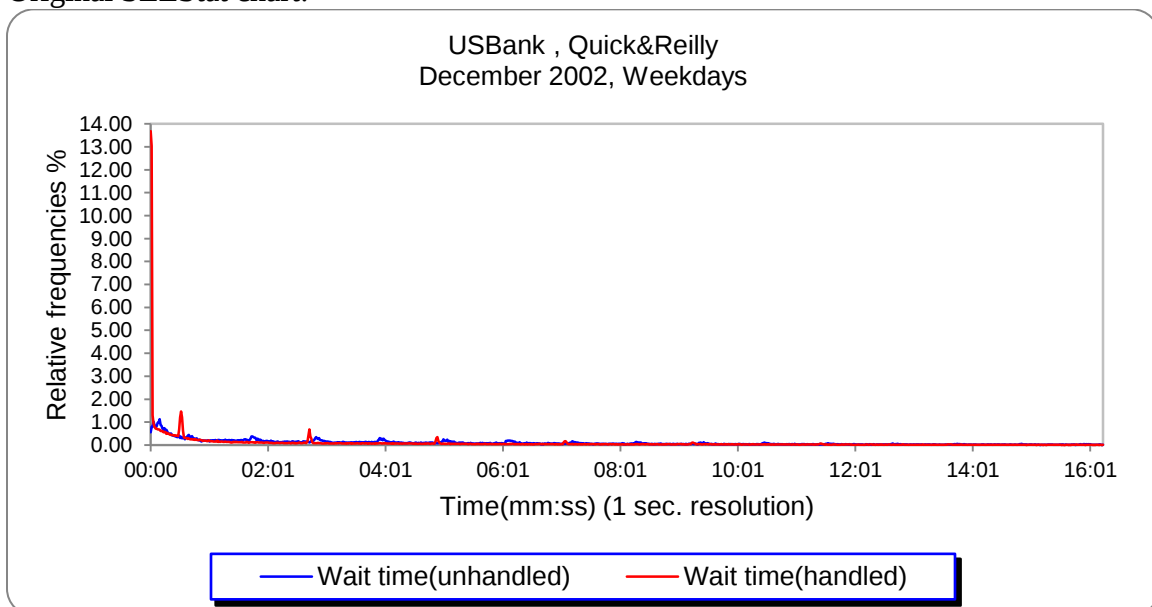
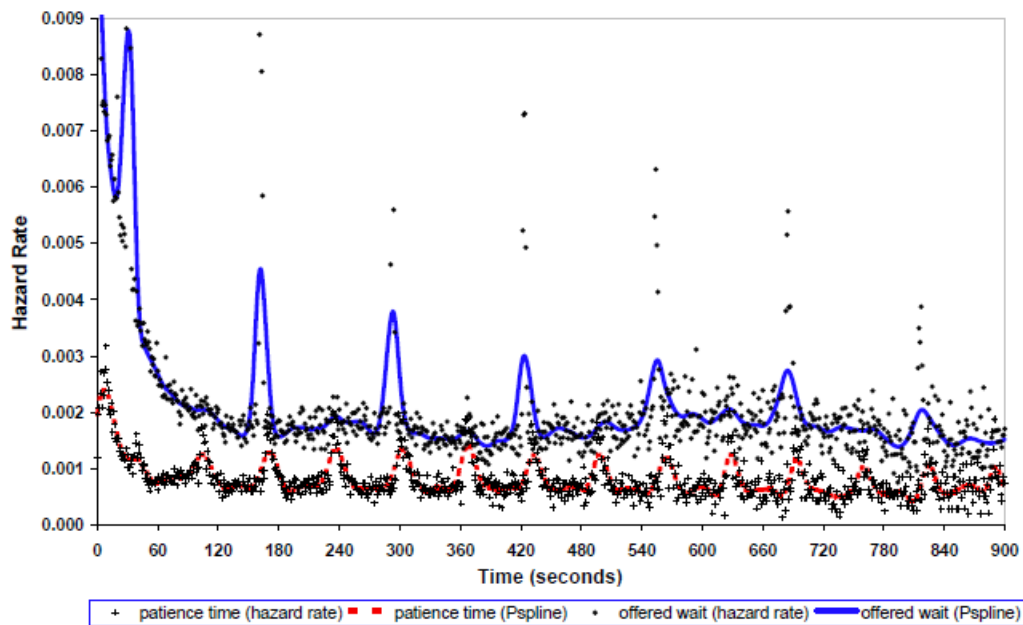
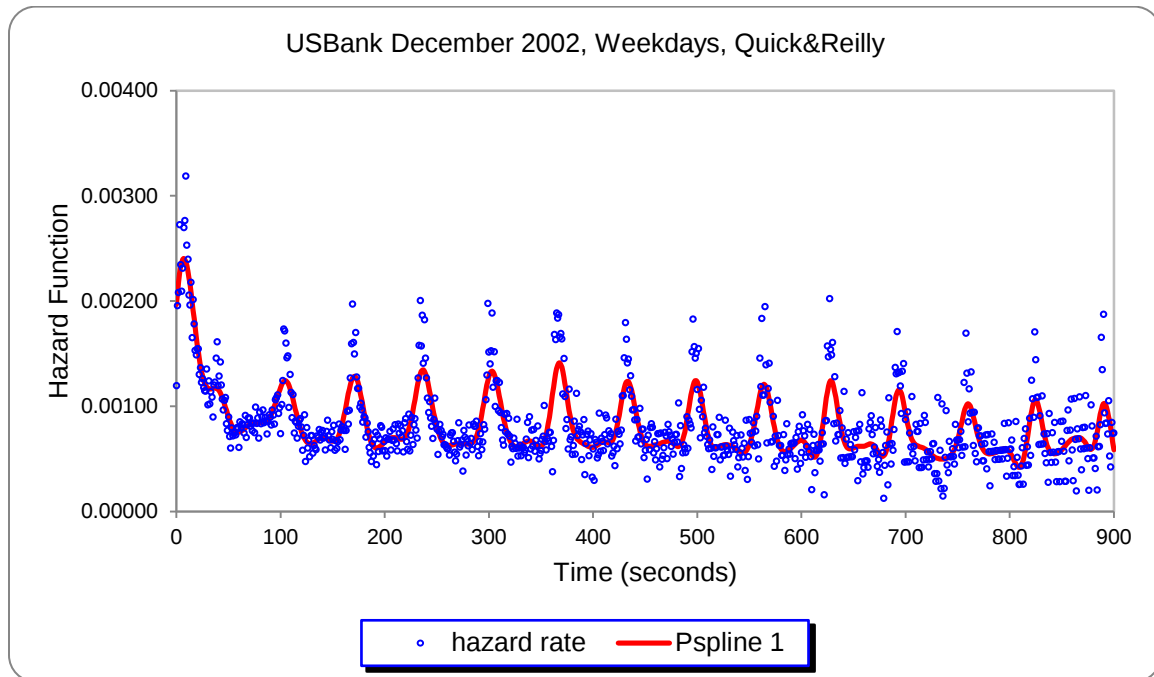


Figure 13: Hazard rates of patience and offered wait in a US bank



SEESat selection		
Study	USBank	
Model	Survival Analysis, Survival Curve Estimate	
Tabs	Censored time	Wait time (handled)
	Failure time	Wait time (unhandled)
	Options	Hazard/Density Charts Options: set limits <i>Use Display Range</i> Select Smoothing: <i>Advanced , Polynomial Smoothing Spline</i> Smoothing Parameter: Smoothing Parameter <i>0.50</i> Order of Smoothing Spline <i>3</i> Smoothing Method: <i>fixed value of smoothing parameter</i> Tables: <i>Summary statistics</i> <i>Smoothing</i> Charts: <i>Hazards</i>
	Select Categories	service <i>Quick&Reilly</i>
	X Properties	Range to Display: Upper Limit (min:sec) <i>15:00</i>
	Dates	<i>Aggregated days, December, 2002</i>

Original SEEStat chart:



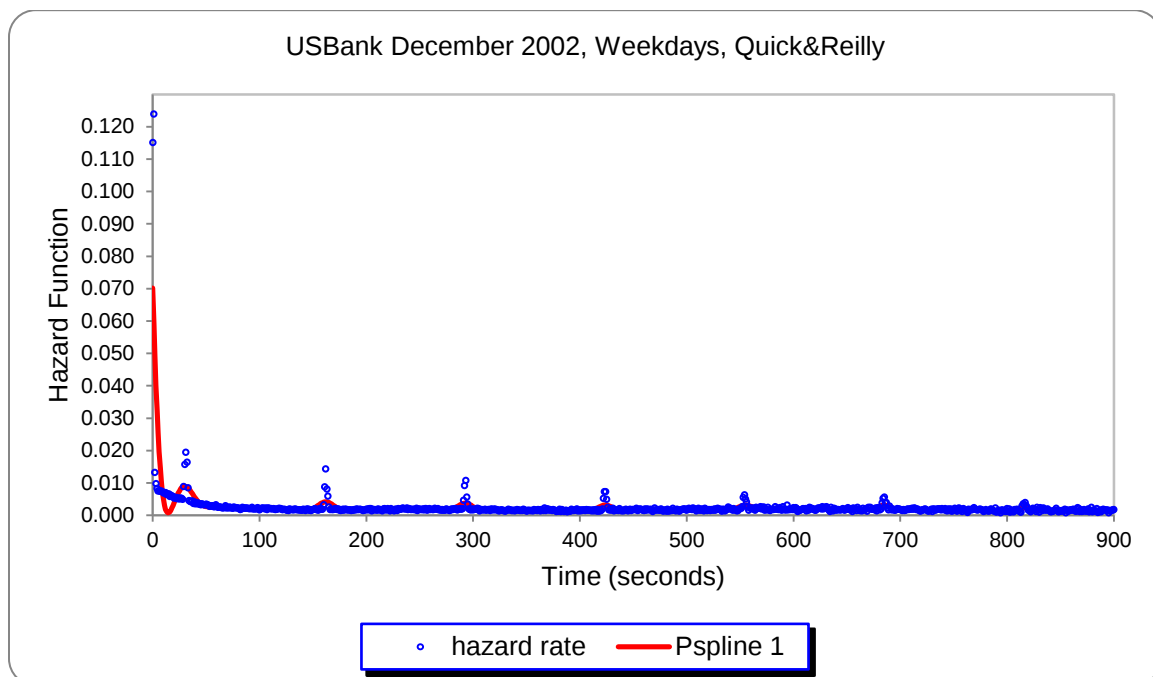
Original SEEStat table:

Summary				
of the Number of Censored and Uncensored Values				
Failure Time: Wait time(unhandled)				
Censored Time: Wait time(handled)				
group	Number of cases	Failed	Censored	Percent Censored
Quick&Reilly	169028	34638	134390	79.51

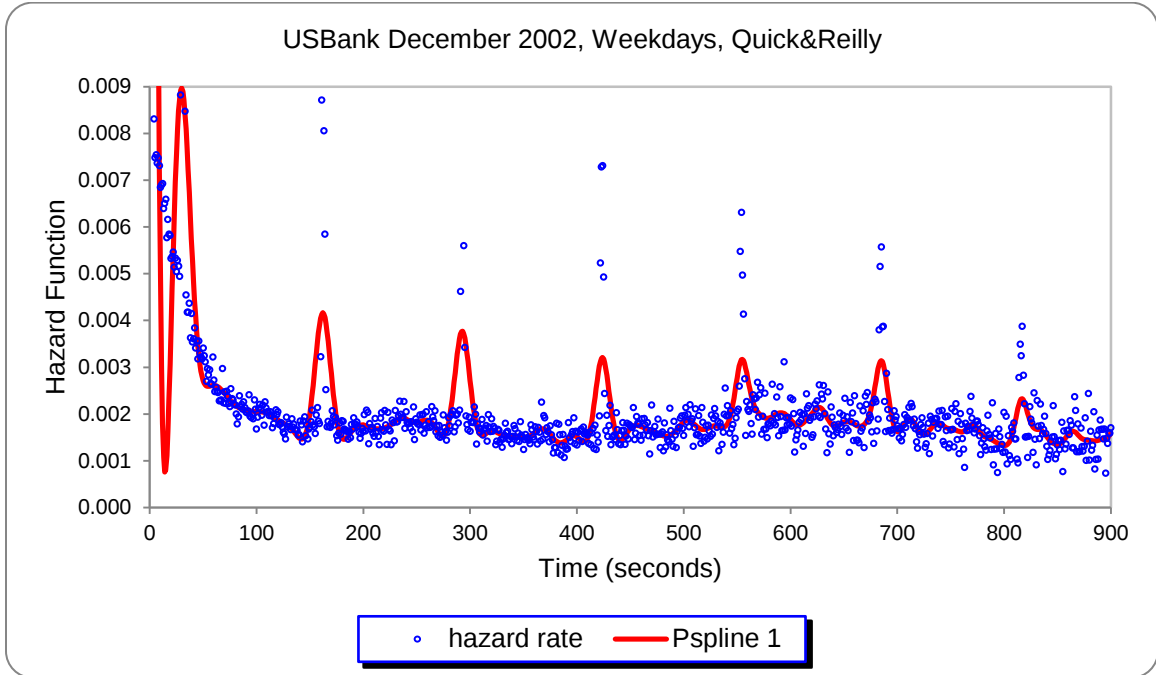
Smoothing Hazard		
id	name	parameters
P spline 1	Polynomial Smoothing Spline	Smoothing Parameter = 0.50
		Order of Smoothing Spline = 3
		Smoothing Method: fixed value of smoothing parameter

SEESat selection		
Study	USBank	
Model	Survival Analysis, Survival Curve Estimate	
Tabs	Censored time	Wait time (unhandled)
	Failure time	Wait time (handled)
	Options	Hazard/Density Charts Options: set limits <i>Use Display Range</i> Select Smoothing: <i>Advanced , Polynomial Smoothing Spline</i> Smoothing Parameter: Smoothing Parameter <i>0.50</i> Order of Smoothing Spline <i>3</i> Smoothing Method: <i>fixed value of smoothing parameter</i> Tables: <i>Summary statistics</i> <i>Smoothing</i> Charts: <i>Hazards</i>
	Select Categories	service <i>Quick&Reilly</i>
	X Properties	Range to Display: Upper Limit (min:sec) <i>15:00</i>
Dates	<i>Aggregated days, December, 2002</i>	

Original SEESat chart:



Modified SEEStat chart:



Original SEEStat table:

Summary				
of the Number of Censored and Uncensored Values				
Failure Time: Wait time(handled)				
Censored Time: Wait time(unhandled)				
group	Number of cases	Failed	Censored	Percent Censored
Quick&Reilly	169028	134390	34638	20.49

Smoothing Hazard		
id	name	parameters
P spline 1	Polynomial Smoothing Spline	Smoothing Parameter = 0.50
		Order of Smoothing Spline = 3
		Smoothing Method: fixed value of smoothing parameter