



Survival Analysis (Analisis Ketahanan)

**Kampus
Merdeka**
INDONESIA JAYA

DISUSUN OLEH:

TRUFI MURDIANI

Dosen Program Bisnis Digital
Fakultas Ekonomi dan Bisnis (FEB) Darmajaya

trufimurdiani@darmajaya.ac.id

IG: @murdiani06



Survival Analysis



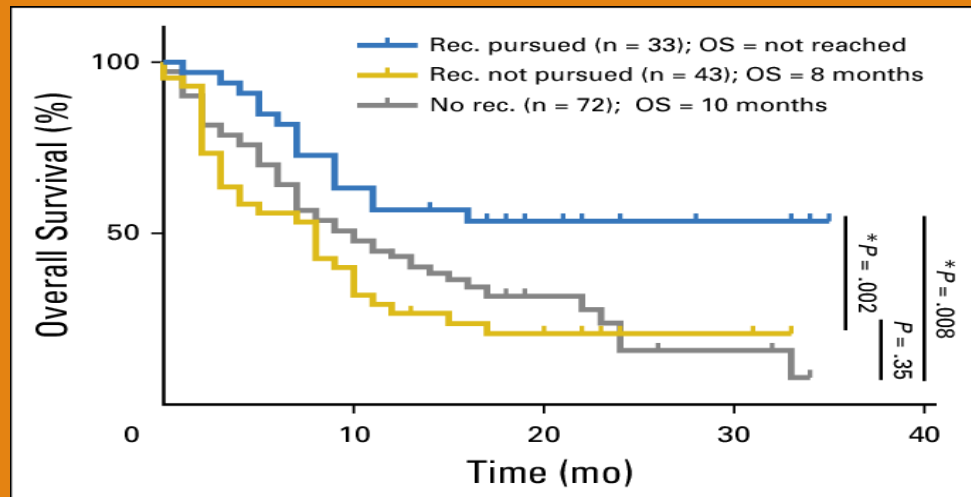
Analisis survival (analisis Ketahanan) adalah prosedur statistika untuk menganalisis data dengan waktu sampai terjadinya suatu peristiwa tertentu (*time until an event occurs*) sebagai variabel respons.

Dalam ilmu Statistik banyak Hal yang diukur dengan satuan waktu, baik tahun, bulan, menit, bahkan detik. Satuan waktu ini biasanya digunakan untuk mengukur suatu kejadian dalam jangka waktu tertentu, ie:

1. Efektifitas Obat dalam jangka waktu tertentu
2. Pengamatan kepuasan konsumen untuk program promo dalam waktu sebulan
3. Efektifitas iklan yang ditayangkan dalam beberapa waktu

Beberapa Tujuan dari Survival Analysis

1. Memperkirakan probabilitas ketahanan sebuah kejadian menurut waktu
2. Membandingkan ketahanan antar kelompok



Dalam Praktek survival test banyak digunakan dalam bidang

1. Kedokteran (mengetahui efektifitas obat, ketahanan pasien terhadap penyakit tertentu dan lainnya)
2. Asuransi seperti kemungkinan pembayaran premi, penentuan besar premi dan lainnya
3. Bidang Bisnis untuk mengukur berbagai aktivitas kejadian yang berbasis waktu, missal: mengukur keberhasilan program member card untuk menarik pelanggan

Prinsip Dasar Survival Analysis

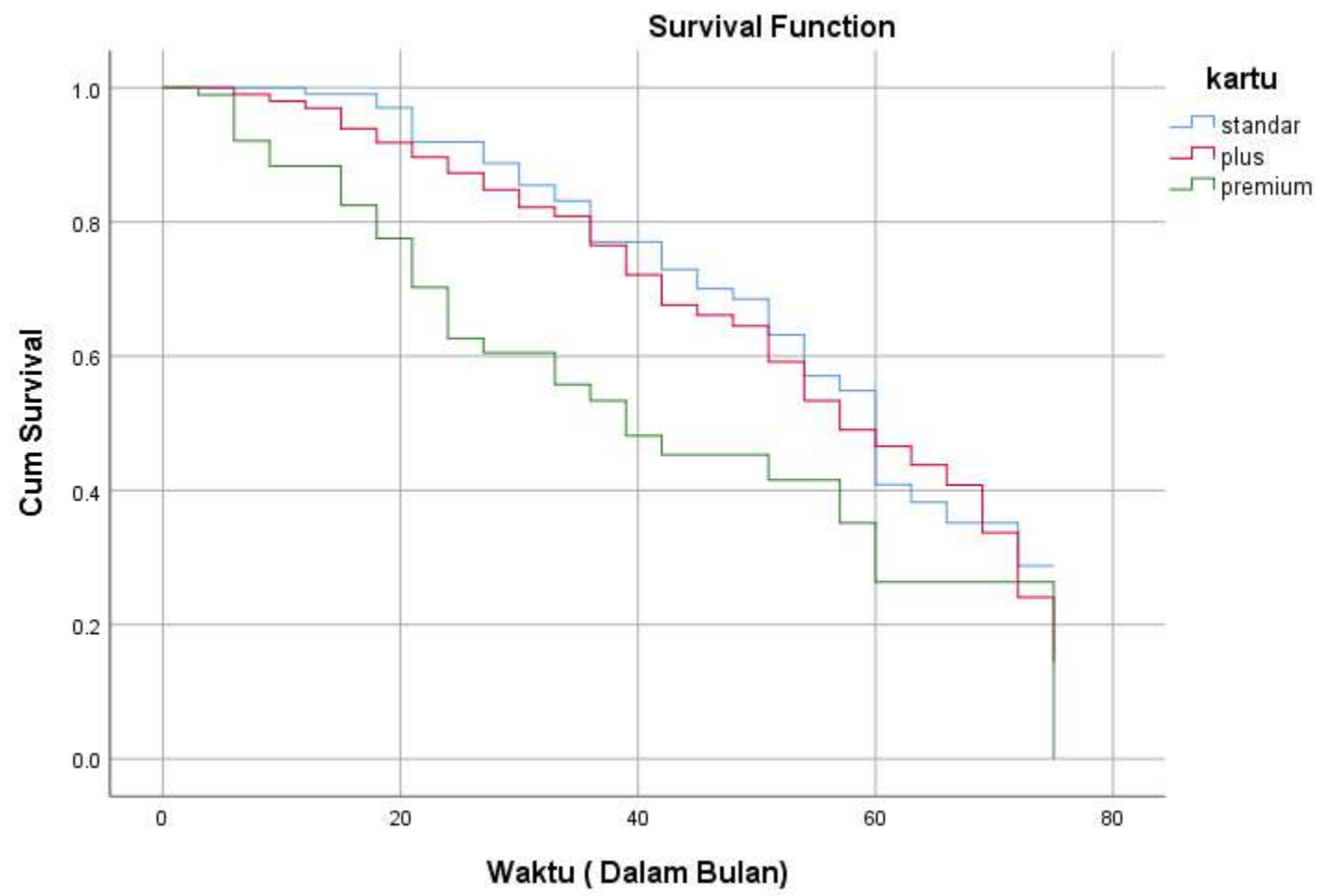


WAKTU

EVENT

SENSOR

HASIL ANALIS SURVIVAL







Untuk mempertahankan loyalitas pelanggannya, sebuah perusahaan memberi pelanggannya 3 jenis kartu anggota (member card), yakni: STANDAR, PLUS, dan PREMIUM. Setiap pelanggan akan mendapatkan satu jenis kartu yang didasarkan pada frekuensi pembelian dan jumlah uang yang dibelanjakannya.

Dengan memiliki kartu tertentu, pelanggan akan mendapatkan fasilitas tertentu yang disertai dengan syarat pembelian minimal tertentu pula. Pelanggan dengan kartu standar akan mendapatkan pelayanan dan persyaratan yang berbeda dengan pelanggan yang tergolong plus atau premium.

Mengingat persaingan yang ketat dan dinamika perilaku konsumen perusahaan memperkirakan pelanggan akan banyak yang berpindah kartu (walaupun diharapkan mereka tidak berpindah kartu). Jika mereka berpindah golongan/kartu ke bank lain, maka perusahaan akan mencatat waktu seseorang memiliki kartu sampai dia memutuskan pindah ke kartu lainnya. Untuk itu perusahaan memantau dan mengumpulkan data 300 kartu pelanggan

DATA KARTU PELANGGAN

	 Responden	 Waktu	 Pindah	 Jenis_Kartu
1	Resp 1	18	Ya	Premium
2	Resp 2	16	Tidak	Premium
3	Resp 3	25	Tidak	Plus
4	Resp 4	13	Ya	Plus
5	Resp 5	20	Ya	Standar
6	Resp 6	34	Tidak	Standar
7	Resp 7	46	Tidak	Plus
8	Resp 8	48	Ya	Plus
9	Resp 9	69	Tidak	Standar
10	Resp 10	12	Ya	Premium
11	Resp 11	29	Tidak	Standar
12	Resp 12	55	Tidak	Plus
13	Resp 13	72	Tidak	Standar
14	Resp 14	5	Tidak	Premium
15	Resp 15	50	Tidak	Standar
16	Resp 16	4	Ya	Premium

Fungsi dan Perintah Survival Analysis

*data survival repo.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

5 :

	Responden		artu	var	var
1	Resp 1		mium		
2	Resp 2		mium		
3	Resp 3		Plus		
4	Resp 4		Plus		
5	Resp 5		andar		
6	Resp 6		andar		
7	Resp 7		Plus		
8	Resp 8		Plus		
9	Resp 9		andar		
10	Resp 10		mium		
11	Resp 11		andar		
12	Resp 12		Plus		
13	Resp 13		andar		
14	Resp 14		mium		
15	Resp 15		andar		
16	Resp 16		mium		
17	Resp 17		andar		
18	Resp 18		Plus		
19	Resp 19		Plus		
20	Resp 20		andar		
21	Resp 21		mium		
22	Resp 22		Plus		
23	Resp 23		Plus		
24	Resp 24		Plus		
25	Resp 25		andar		
26	Resp 26		mium		

Reports
Descriptive Statistics
Bayesian Statistics
Tables
Compare Means
General Linear Model
Generalized Linear Models
Mixed Models
Correlate
Regression
Loglinear
Neural Networks
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Missing Value Analysis...
Multiple Imputation
Complex Samples
Simulation...
Quality Control
ROC Curve...
Spatial and Temporal Modeling...
Direct Marketing
IBM SPSS Amos...

Life Tables...
Kaplan-Meier...
Cox Regression...
Cox w/ Time-Dep Cov...

Plus

Life Tables

Jenis_Kartu

Time: Waktu

Display Time Intervals
0 through 75 by 3

Status: Pindah(1)

Define Event...

Life Tables: Define Event for Status Variable

Value(s) Indicating Event Has Occurred
 Single value: 1
 Range of values: through

Continue Cancel Help

OK Paste Reset Cancel Help

25	Tidak	
13	Ya	
20	Ya	
34	Tidak	
46	Tidak	
48	Ya	
69	Tidak	
12	Ya	P
29	Tidak	
55	Tidak	
72	Tidak	
5	Tidak	P
50	Tidak	
4	Ya	P
11	Tidak	
29	Tidak	
51	Ya	
33	Tidak	
4	Ya	P
31	Tidak	

Life Tables

Jenis_Kartu

Life Tables: Options

Life table(s)

Plot
 Survival Log survival
 Hazard Density
 One minus survival

Compare Levels of First Factor
 None
 Overall
 Pairwise

Continue Cancel Help

OK Paste Reset Cancel Help

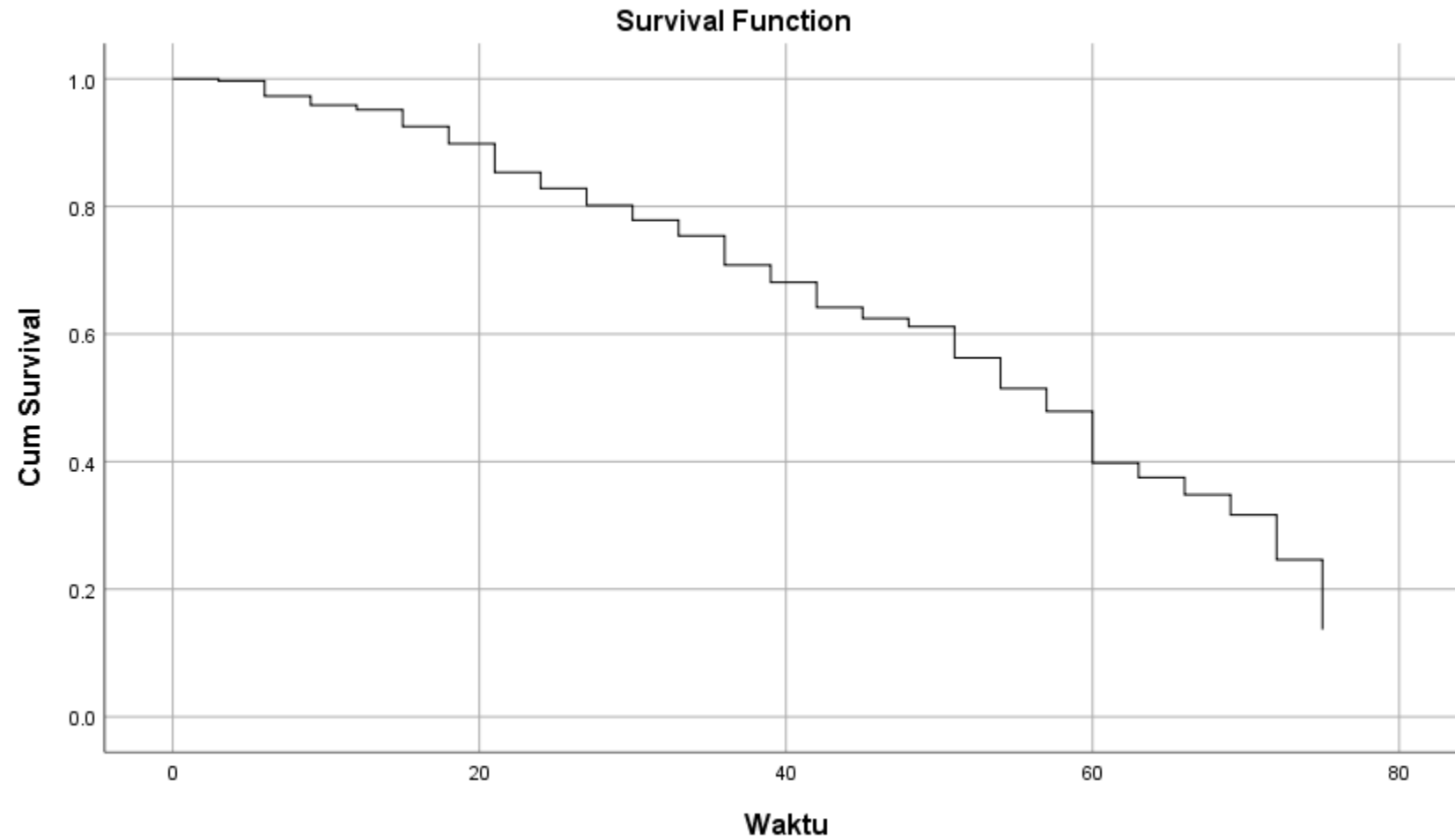
TABEL HASIL

Life Table^a

Interval Start Time	Number Entering Interval	Number Withdrawing during Interval	Number Exposed to Risk	Number of Terminal Events	Proportion Terminating	Proportion Surviving	Cumulative Proportion Surviving at End of Interval	Std. Error of Cumulative Proportion Surviving at End of Interval	Probability Density	Std. Error of Probability Density	Hazard Rate	Std. Error of Hazard Rate
0	300	0	300.000	1	.00	1.00	1.00	.00	.001	.001	.00	.00
3	299	12	293.000	7	.02	.98	.97	.01	.008	.003	.01	.00
6	280	7	276.500	4	.01	.99	.96	.01	.005	.002	.00	.00
9	269	7	265.500	2	.01	.99	.95	.01	.002	.002	.00	.00
12	260	9	255.500	7	.03	.97	.93	.02	.009	.003	.01	.00
15	244	12	238.000	7	.03	.97	.90	.02	.009	.003	.01	.00
18	225	7	221.500	11	.05	.95	.85	.02	.015	.004	.02	.01
21	207	8	203.000	6	.03	.97	.83	.02	.008	.003	.01	.00
24	193	13	186.500	6	.03	.97	.80	.03	.009	.004	.01	.00
27	174	5	171.500	5	.03	.97	.78	.03	.008	.003	.01	.00
30	164	8	160.000	5	.03	.97	.75	.03	.008	.004	.01	.00
33	151	7	147.500	9	.06	.94	.71	.03	.015	.005	.02	.01
36	135	7	131.500	5	.04	.96	.68	.03	.009	.004	.01	.01
39	123	3	121.500	7	.06	.94	.64	.03	.013	.005	.02	.01
42	113	6	110.000	3	.03	.97	.62	.03	.006	.003	.01	.01
45	104	9	99.500	2	.02	.98	.61	.03	.004	.003	.01	.00
48	93	12	87.000	7	.08	.92	.56	.04	.016	.006	.03	.01
51	74	7	70.500	6	.09	.91	.51	.04	.016	.006	.03	.01
54	61	8	57.000	4	.07	.93	.48	.04	.012	.006	.02	.01
57	49	3	47.500	8	.17	.83	.40	.04	.027	.009	.06	.02
60	38	7	34.500	2	.06	.94	.37	.04	.008	.005	.02	.01
63	29	2	28.000	2	.07	.93	.35	.04	.009	.006	.02	.02
66	25	6	22.000	2	.09	.91	.32	.04	.011	.007	.03	.02
69	17	7	13.500	3	.22	.78	.25	.05	.023	.012	.08	.05
72	7	5	4.500	2	.44	.56	.14	.06	.036	.021	.19	.13

a. The median survival time is 55.22

Survival Diagram



DATA DENGAN KATEGORISASI

*data survival repo.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

5:

	Responden		
1	Resp 1		
2	Resp 2		
3	Resp 3		
4	Resp 4		
5	Resp 5		
6	Resp 6		
7	Resp 7		
8	Resp 8		
9	Resp 9		
10	Resp 10		
11	Resp 11		
12	Resp 12		
13	Resp 13		
14	Resp 14		
15	Resp 15		
16	Resp 16		
17	Resp 17		
18	Resp 18		
19	Resp 19		
20	Resp 20		
21	Resp 21		
22	Resp 22		
23	Resp 23		
24	Resp 24		
25	Resp 25		
26	Resp 26		

Reports
Descriptive Statistics
Bayesian Statistics
Tables
Compare Means
General Linear Model
Generalized Linear Models
Mixed Models
Correlate
Regression
Loglinear
Neural Networks
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Missing Value Analysis...
Multiple Imputation
Complex Samples
Simulation...
Quality Control
ROC Curve...
Spatial and Temporal Modeling...
Direct Marketing
IBM SPSS Amos...

artu
var
var
mium
mium
Plus
Plus
andar
andar
Plus
Plus
andar
mium
andar
Plus
andar
mium
andar
mium

Life Tables...
Kaplan-Meier...
Cox Regression...
Cox w/ Time-Dep Cov...

Life Tables

Time: Waktu

Display Time Intervals
0 through 75 by 3

Status: Pindah(1)
Define Event...

Factor: Jenis_Kartu(? ?)
Define Range...

Life Tables: Define Range for...
Minimum: 1
Maximum: 3
Continue Cancel Help

Life Tables

Time: Waktu

Display Time Intervals
0 through 75 by 3

Status: Pindah(1)
Define Event...

Factor: Jenis_Kartu(? ?)
Define Range...

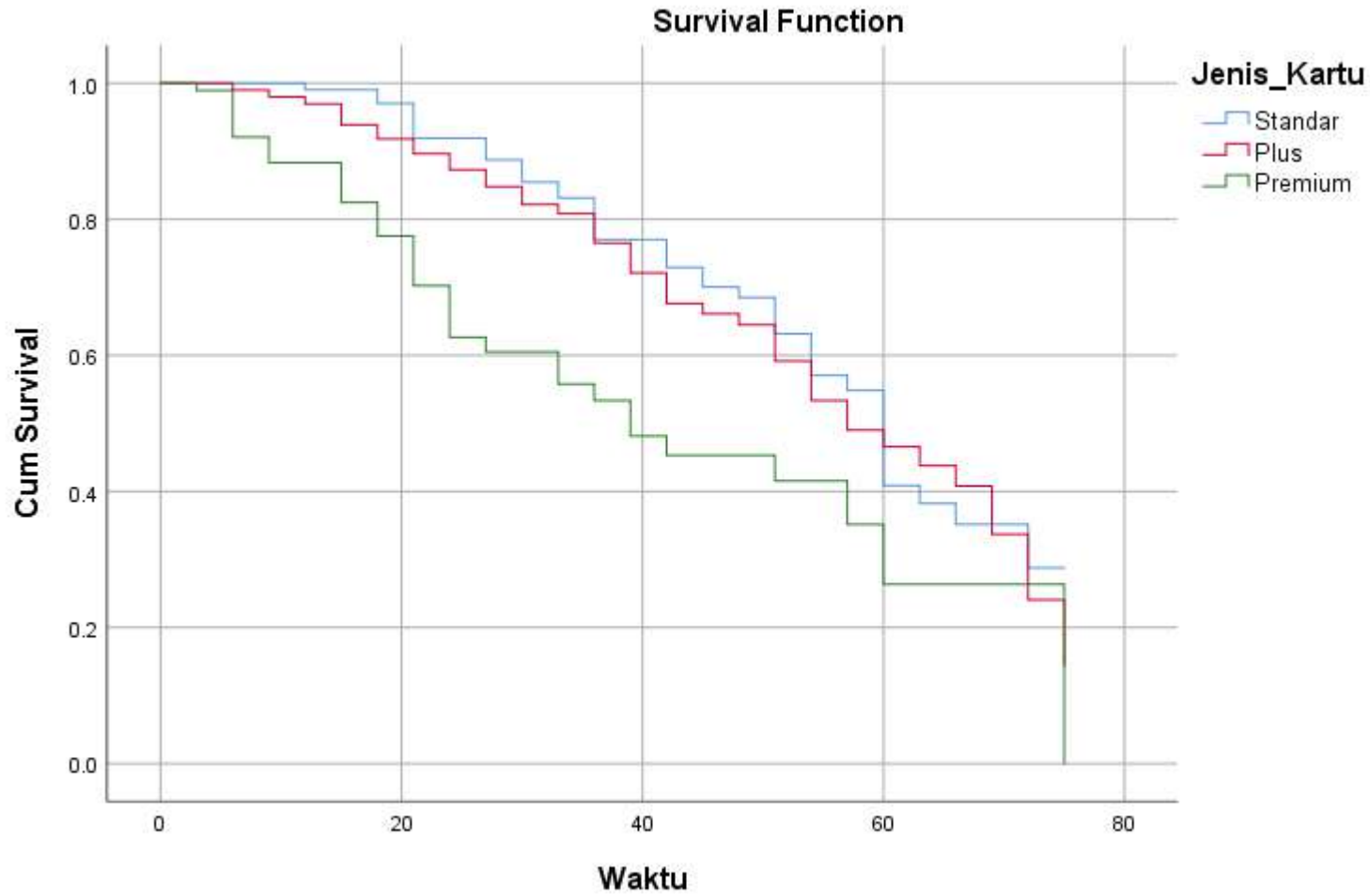
Life Tables: Options
 Life tables(s)
 Plot
 Survival Log survival
 Hazard Density
 One minus survival
 Compare Levels of First Factor
 None
 Overall
 Pairwise

Continue Cancel Help

Tabel Hasil

		Life Table											
First Order Controls	Interval Start Time	Number Entering Interval	Number Withdrawing during Interval	Number Exposed to Risk	Number of Terminal Events	Proportion Terminating	Proportion Surviving	Cumulative Proportion Surviving at End of Interval	Std. Error of Cumulative Proportion Surviving at End of Interval	Probability Density	Std. Error of Probability Density	Hazard Rate	Std. Error of Hazard Rate
Jenis_Kartu	Standar	0	100	0	100.000	0	.00	1.00	1.00	.00	.000	.00	.00
		3	100	3	100.500	0	.00	1.00	1.00	.00	.000	.00	.00
		6	105	0	105.000	0	.00	1.00	1.00	.00	.000	.00	.00
		9	105	2	104.000	1	.01	.99	.99	.01	.003	.003	.00
		12	102	3	100.500	0	.00	1.00	.99	.01	.000	.000	.00
		15	99	3	98.000	2	.02	.98	.97	.02	.007	.005	.01
		18	95	0	95.000	5	.05	.95	.92	.03	.017	.007	.01
		21	90	3	89.000	0	.00	1.00	.93	.03	.000	.000	.00
		24	88	3	87.000	3	.03	.97	.89	.03	.011	.006	.01
		27	83	4	81.000	3	.04	.96	.85	.04	.014	.006	.01
		30	76	4	74.000	2	.03	.97	.83	.04	.006	.005	.01
		33	70	4	66.000	5	.07	.93	.77	.04	.020	.009	.03
		36	61	4	59.000	0	.00	1.00	.77	.04	.000	.000	.00
		39	57	2	56.000	3	.05	.95	.73	.05	.014	.009	.02
		42	52	2	51.000	2	.04	.96	.70	.05	.010	.007	.01
		45	48	5	45.000	5	.02	.98	.69	.05	.005	.006	.01
		48	43	7	38.000	3	.08	.92	.63	.06	.018	.010	.03
		51	32	2	31.000	3	.10	.90	.57	.06	.020	.011	.03
		54	27	3	26.000	1	.04	.96	.56	.06	.007	.007	.01
		57	24	1	23.500	6	.26	.74	.41	.07	.047	.017	.10
		60	17	3	15.500	1	.06	.94	.36	.07	.009	.009	.02
		63	13	1	12.500	1	.08	.92	.35	.07	.010	.010	.03
		66	11	3	9.500	0	.00	1.00	.35	.07	.000	.000	.00
		69	9	0	5.500	1	.10	.90	.29	.08	.021	.020	.07
		72	2	2	1.000	2	.00	1.00	.29	.08	.000	.000	.00
		0	100	0	100.000	0	.00	1.00	1.00	.00	.000	.000	.00
	Plus	3	100	1	99.000	1	.01	.99	.99	.01	.003	.003	.00
		6	98	0	98.000	1	.01	.99	.98	.01	.003	.003	.00
		9	97	1	96.000	1	.01	.99	.97	.02	.003	.003	.00
		12	96	1	94.500	3	.03	.97	.94	.02	.010	.006	.01
		15	91	2	90.000	2	.02	.98	.92	.03	.007	.005	.01
		18	87	6	84.000	2	.02	.98	.90	.03	.007	.005	.01
		21	79	4	77.000	2	.03	.97	.87	.03	.000	.005	.01
		24	73	0	70.000	2	.03	.97	.85	.04	.009	.006	.01
		27	65	1	64.500	2	.03	.97	.82	.04	.009	.006	.01
		30	62	3	60.500	1	.02	.98	.81	.04	.005	.004	.01
		33	58	3	56.000	3	.05	.95	.77	.05	.014	.008	.02
		36	52	0	52.000	3	.06	.94	.73	.05	.015	.008	.02
		39	49	1	48.500	3	.06	.94	.68	.05	.015	.008	.02
		42	45	2	44.000	1	.02	.98	.66	.05	.005	.005	.01
		45	42	3	40.500	1	.02	.98	.64	.05	.005	.005	.01
		48	39	3	36.500	3	.08	.92	.59	.06	.010	.010	.03
		51	32	3	30.500	3	.10	.90	.53	.06	.019	.011	.03
		54	20	3	24.500	2	.09	.92	.49	.06	.015	.010	.03
		57	21	2	20.000	1	.05	.95	.47	.07	.009	.009	.02
		60	18	2	17.000	1	.06	.94	.44	.07	.009	.009	.02
		63	18	1	14.000	1	.07	.93	.41	.07	.010	.010	.03
		66	13	3	11.000	2	.17	.83	.34	.07	.024	.016	.06
		69	8	2	7.000	2	.29	.71	.34	.08	.032	.020	.11
		72	4	3	2.500	1	.40	.60	.14	.09	.032	.027	.16
	Premium	0	92	0	92.000	1	.01	.99	.99	.01	.004	.004	.00
		3	91	0	91.000	1	.01	.99	.98	.03	.009	.009	.02
		6	77	7	73.500	3	.04	.96	.96	.03	.013	.007	.01
		9	67	4	65.000	0	.00	1.00	.99	.03	.000	.000	.00
		12	63	5	60.500	4	.07	.93	.92	.04	.019	.009	.02
		15	54	8	50.000	3	.06	.94	.78	.05	.016	.009	.02
		18	43	1	42.000	4	.09	.91	.70	.05	.024	.012	.03
		21	38	2	37.000	4	.11	.89	.63	.05	.025	.012	.03
		24	32	6	29.500	1	.03	.97	.61	.06	.007	.007	.01
		27	26	0	26.000	0	.00	1.00	.61	.06	.000	.000	.00
		30	26	1	25.500	2	.08	.92	.56	.07	.016	.011	.03
		33	23	0	23.000	1	.04	.96	.53	.07	.009	.009	.02
		36	22	3	20.500	2	.10	.90	.49	.07	.017	.012	.03
		39	17	0	17.000	1	.06	.94	.45	.07	.009	.009	.02
		42	16	2	15.000	0	.00	1.00	.45	.07	.000	.000	.00
		45	14	1	13.000	0	.00	1.00	.45	.07	.000	.000	.00
		48	13	2	12.000	1	.08	.92	.43	.08	.013	.012	.03
		51	10	3	9.000	0	.00	1.00	.42	.08	.000	.000	.00
		54	8	3	6.000	1	.15	.85	.35	.08	.031	.020	.06
		57	4	0	4.000	1	.25	.75	.26	.10	.029	.026	.10
		60	3	2	2.000	0	.00	1.00	.26	.10	.000	.000	.00
		63	1	0	1.000	0	.00	1.00	.26	.10	.000	.000	.00
		66	1	0	1.000	0	.00	1.00	.26	.10	.000	.000	.00
		69	1	0	1.000	0	.00	1.00	.26	.10	.000	.000	.00
		72	1	0	1.000	1	1.00	.00	.00	.00	.000	.000	.00

Survival Diagram dan Median



Median Survival Time

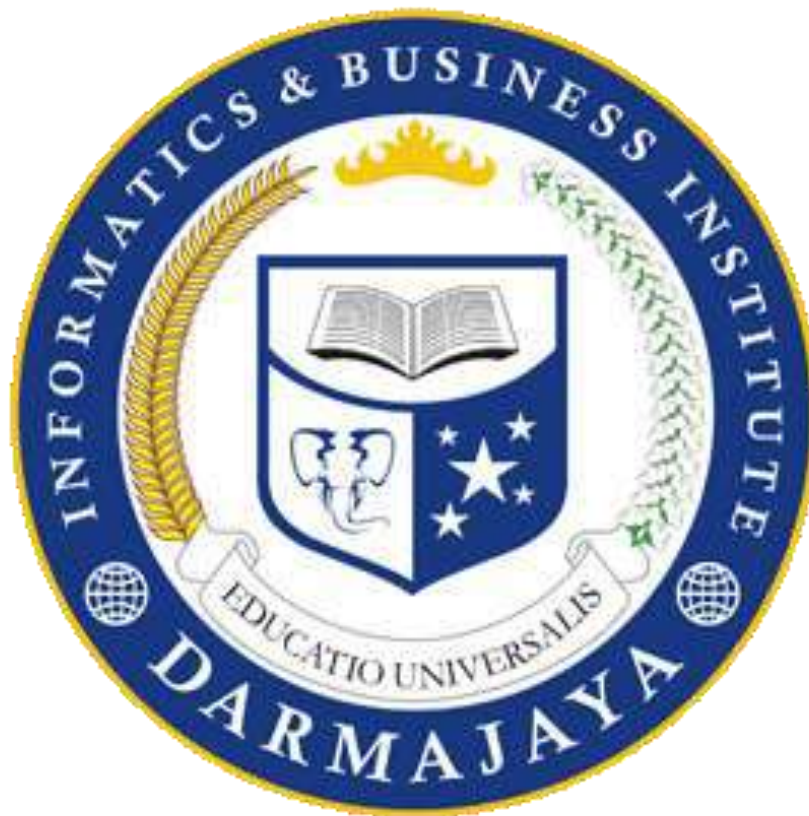
First-order Controls		Med Time
Jenis_Kartu	Standar	58.04
	Plus	56.31
	Premium	37.93

Overall Comparisons^a

Wilcoxon (Gehan) Statistic	df	Sig.
18.871	2	.000

a. Comparisons are exact.

END OF SLIDE



STARTUP



STRATEGY



BUSINESS MANAGEMENT



PARTNERSHIP