Tariffazione con i GLM

Statistica Assicurativa

Leonardo Stincone, 10/02/2020

```
/* Percorso in cui si trovano i dati */
libname dati '/folders/myfolders/data';

/* Parametri grafici */
ods graphics on / width = 10cm height = 8cm;

/* Carico il dataset con le polizze */
data polizze;
    set dati.polizze;
run;

data polizze;
    set polizze;
    freqsin = nsin / espo;
run;

/* Creo un dataset con le sole polizze sinistrate */
data polizze_sin;
    set polizze;
    where nsin > 0;
    dannomedio = dannotot / nsin;
run;

proc print data = polizze (obs=10) round;
run;
```

```
SAS Connection established. Subprocess id is 2476
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin
1	F	35	MI	NO	B	18	620	10	1.0	0	0.00	0
2	M	37	AP	NO	B	37	790	12	1.0	0	0.00	0
3	M	45	LE	NO	B	63	850	15	1.0	0	0.00	0
4	F	21	PS	NO	B	34	710	13	1.0	0	0.00	0
5	M	48	SP	NO	B	33	770	12	0.2	0	0.00	0
6	F	45	TO	NO	B	44	780	14	1.0	0	0.00	0
7	M	35	PG	NO	D	51	1035	19	1.0	0	0.00	0
8	M	70	PG	SI	B	65	970	15	1.0	0	0.00	0
9	F	46	AR	NO	B	61	820	15	1.0	0	0.00	0
10	M	55	AR	NO	B	80	1180	18	1.0	1	359.06	1

1) Analisi preliminari

```
proc means data = polizze nway noprint;
    var espo nsin dannotot;
    output out = polizzeMeans sum = totespo totnsin totdannotot;
run;

data polizzeMeans;
    set polizzeMeans;

    totfreqsin = totnsin / totespo;
    if totnsin > 0 then totdannomed = totdannotot / totnsin;
        else totdannomed=0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;

    format totfreqsin 5.3;
    format totespo 10.2;
    format totdannotot 10.2;
    format totqd 10.2;
```

```
run;

proc print data = polizzeMeans noobs round;
    var totfreqsin totdannomed totqd totespo;
run;
```

totfreqsin	totdannomed	totqd	totespo
0.103	3000	308.83	123282.32

```
proc means data = polizze maxdec = 2;
    var eta potf potkil massa;
    weight espo;
run;
```

The MEANS Procedure

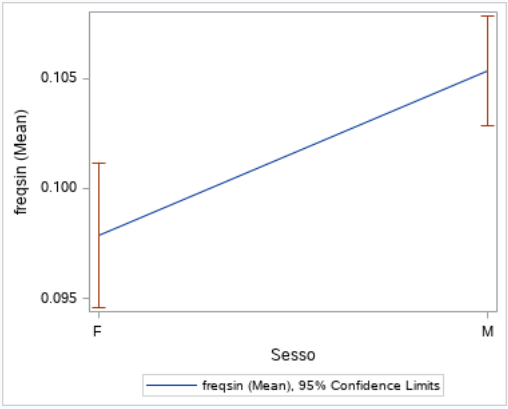
Variable	Label	N	Mean	Std Dev	Minimum	Maximum
Eta	Eta	172161	42.64	12.20	18.00	95.00
potf		172161	14.85	2.66	8.00	41.00
Potkil	Potkil	172161	51.54	19.79	17.00	362.00
Massa	Massa	172161	920.92	169.66	555.00	2240.00

1. Sesso

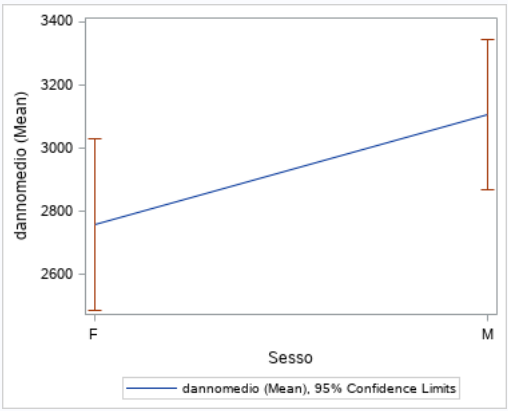
```
proc means data = polizze nway noprint;
    class sesso;
    var espo nsin dannotot;
    output out = polizzebysesso sum = totespo totnsin totdannotot;
run;

data polizzebysesso;
    set polizzebysesso;

    totfreqsin = totnsin / totespo;
    if totnsin > 0 then totdannomed = totdannotot / totnsin;
        else totdannomed=0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;

    format totfreqsin 5.3;
    format totespo 10.2;
    format totdannotot 10.2;
    format totqd 10.2;
run;

proc print data = polizzebysesso noobs;
    var sesso totfreqsin totdannomed totqd totespo;
run;
```

Sesso	totfreqsin	totdannomed	totqd	totespo
F	0.098	2758.37	269.97	39735.73
M	0.105	3106.76	327.31	83546.59

```
proc sgplot data=polizze;
    vline sesso / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05;
run;
```




```
proc sgplot data=polizze_sin;
    vline sesso / response=dannomedio weight=nsin stat=mean limitstat=clm alpha = .05;
run;
```

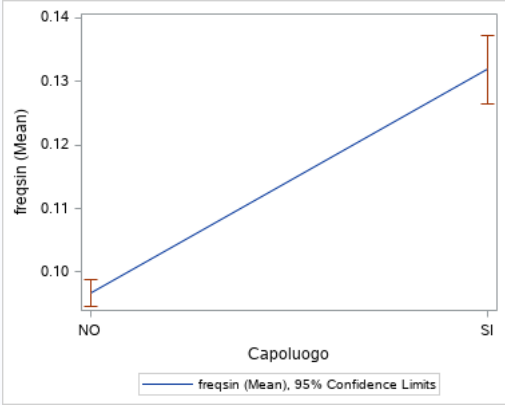


2. Capoluogo

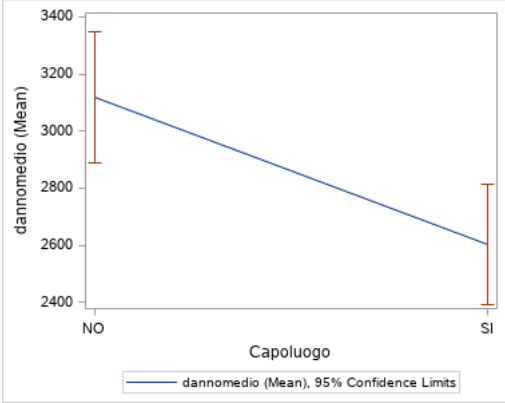
```
proc means data = polizze nway noprint;
    class capoluogo;
    var espo nsin dannotot;
    output out = polizzebycapoluogo sum = totespo totnsin totdannotot;
run;

data polizzebycapoluogo;
    set polizzebycapoluogo;

    totfreqsin = totnsin / totespo;
    if totnsin > 0 then totdannomed = totdannotot / totnsin;
        else totdannomed=0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;

    format totfreqsin 5.3;
    format totespo 10.2;
    format totdannotot 10.2;
    format totqd 10.2;
run;

proc print data=polizzebycapoluogo noobs;
    var capoluogo totfreqsin totdannomed totqd totespo;
run;
```

Capoluogo	totfreqsin	totdannomed	totqd	totespo
NO	0.097	3117.84	301.35	101269.74
SI	0.132	2602.67	343.24	22012.58

```
proc sgplot data=polizze;
    vline capoluogo / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05;
run;
```




```
proc sgplot data=polizze_sin;
    vline capoluogo / response=dannomedio weight=nsin stat=mean limitstat=clm alpha = .05;
run;
```



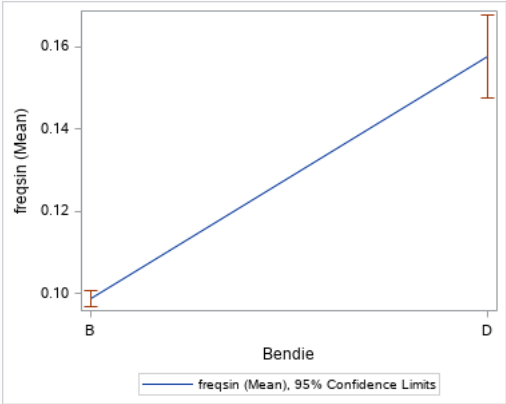
3. Bendie

```
proc means data = polizze nway noprint;
    class bendie;
    var espo nsin dannotot;
    output out=polizzebybendie sum=totespo totnsin totdannotot;
run;

data polizzebybendie;
    set polizzebybendie;

    totfreqsin = totnsin / totespo;
    if totnsin > 0 then totdannomed = totdannotot / totnsin;
        else totdannomed=0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;

    format totfreqsin 5.3;
    format totespo 10.2;
    format totdannotot 10.2;
    format totqd 10.2;
run;

proc print data = polizzebybendie noobs;
    var bendie totfreqsin totdannomed totqd totespo;
run;
```

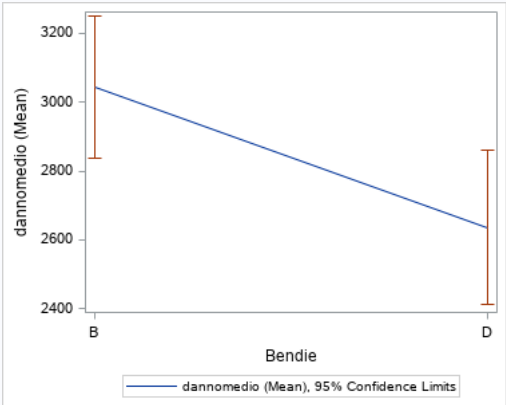
Bendie	totfreqsin	totdannomed	totqd	totespo
B	0.099	3044.79	300.60	114456.64

Bendie	totfreqsin	totdannomed	totqd	totespo
D	0.158	2636.14	415.48	8825.68

```
proc sgplot data=polizze;
    vline bendie / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05;
run;
```




```
proc sgplot data=polizze_sin;
    vline bendie / response=dannomedio weight=nsin stat=mean limitstat=clm alpha = .05;
run;
```



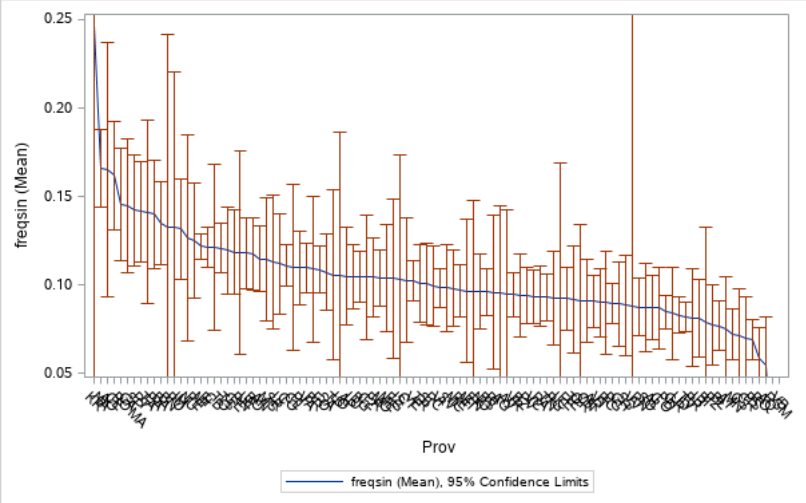
4. Prov

```
proc means data = polizze nway noprint;
    class prov;
    var espo nsin dannotot;
    output out = polizzebyprov sum = totespo totnsin totdannotot;
run;

data polizzebyprov;
    set polizzebyprov;

    totfreqsin = totnsin / totespo;
    if totnsin > 0 then totdannomed = totdannotot / totnsin;
        else totdannomed=0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;

    format totfreqsin 5.3;
    format totespo 10.2;
    format totdannotot 10.2;
    format totqd 10.2;
run;

proc sort data = polizzebyprov;
    by descending totfreqsin;
run;
```

```
proc print data = polizzebyprov (obs = 10);
    var prov totfreqsin totdannomed totqd totespo;
run;
```

Obs	Prov	totfreqsin	totdannomed	totqd	totespo
1	KR	0.247	3052.88	753.71	8.10
2	NA	0.166	2255.60	374.41	2138.67
3	AO	0.165	1607.49	265.26	145.44
4	CE	0.162	1999.70	323.63	1211.09
5	ROMA	0.146	2239.97	326.51	617.43
6	CA	0.145	2485.66	359.45	567.04
7	SP	0.142	3161.38	449.80	611.48
8	PT	0.142	3019.11	427.32	847.82
9	TA	0.141	1735.74	244.96	524.35
10	PA	0.140	2130.07	298.28	692.70

```
/* Parametri grafici */
ods graphics on / width = 16cm height = 10cm;

proc sgplot data=polizze;
    vline prov / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05
                 categoryorder=respdesc;
    yaxis min = 0.05 max = 0.25;
run;
```



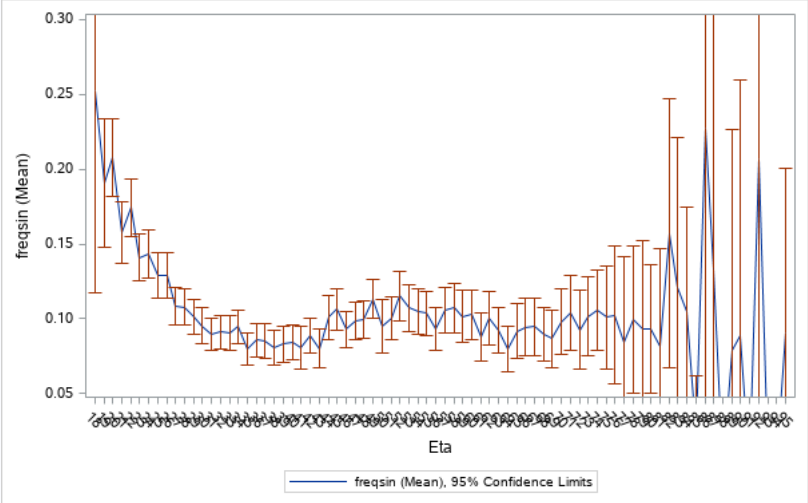
5. eta

```
proc means data = polizze nway noprint;
    class eta;
    var espo nsin dannotot;
    output out = polizzebyeta sum = totespo totnsin totdannotot;
run;

data polizzebyeta;
    set polizzebyeta;

    totfreqsin = totnsin / totespo;
    if totnsin > 0 then totdannomed = totdannotot / totnsin;
        else totdannomed=0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;

    format totfreqsin 5.3;
    format totespo 10.2;
    format totdannotot 10.2;
    format totqd 10.2;
run;
```

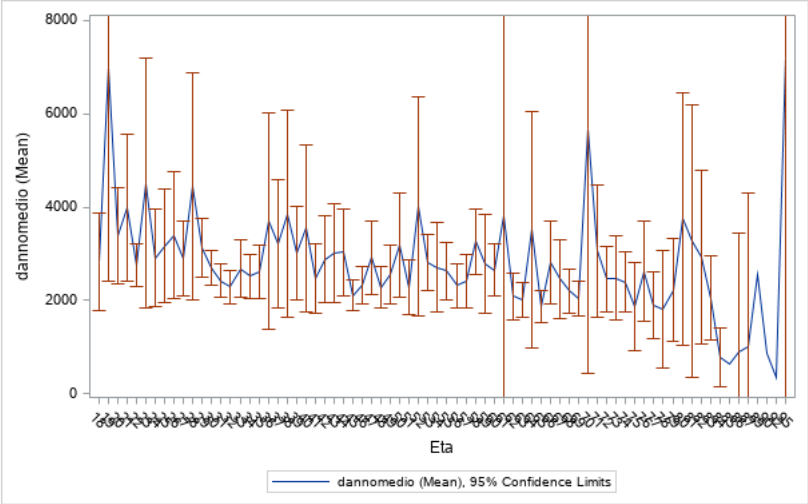
```
proc print data = polizzebyeta (obs=10) noobs;
    var eta totfreqsin totdannomed totqd totespo;
run;
```

Eta	totfreqsin	totdannomed	totqd	totespo
18	0.253	2816.35	711.71	91.01
19	0.190	6995.11	1332.43	593.24
20	0.208	3387.97	703.64	1266.33
21	0.158	3988.27	629.14	1939.81
22	0.174	2767.00	482.41	2156.65
23	0.141	4512.06	636.44	2566.41
24	0.144	2912.02	417.98	2724.07
25	0.129	3168.98	408.31	2832.83
26	0.129	3389.06	437.45	2974.93
27	0.108	2897.50	313.58	3132.37

```
proc sgplot data=polizze;
    vline eta / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05;
    yaxis min = 0.05 max = 0.30;
run;
```




```
proc sgplot data=polizze_sin;
    vline eta / response=dannomedio weight=nsin stat=mean limitstat=clm alpha = .05;
    yaxis min = 0 max = 8000;
run;
```



2) Cluster Analysis

2.1. Prov

```
proc cluster method = ward data = polizzebyprov outtree = clusterprov print = 5;
    id prov;
    var totfreqsin;
    freq totespo;
    copy totespo totnsin totdannotot totdannomed;
run;
```

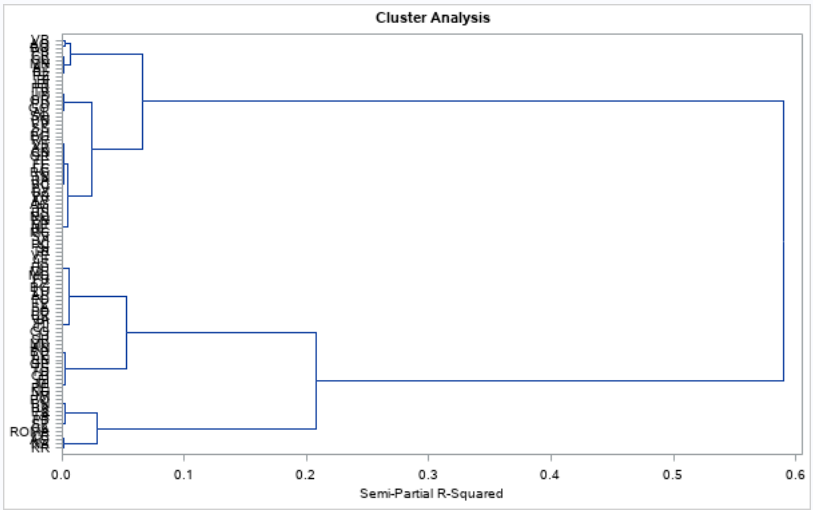
The CLUSTER Procedure
Ward's Minimum Variance Cluster Analysis

Eigenvalues of the Covariance Matrix				
	Eigenvalue	Difference	Proportion	Cumulative
1	0.00040350		1.0000	1.0000

Root-Mean-Square Total-Sample Standard Deviation	0.020087

Root-Mean-Square Distance Between Observations	0.028408

Cluster History						
Number of Clusters	Clusters Joined		Freq	Semipartial R-Square	R-Square	Tie
5	CL16	CL10	9515	0.0285	.917	
4	CL11	CL8	52015	0.0528	.864	
3	CL6	CL7	61702	0.0656	.798	
2	CL5	CL4	61530	0.2080	.590	
1	CL2	CL3	123232	0.5902	.000	




```
/* clusterprov contiene una riga per ogni passo della procedura di clustering */
proc print data = clusterprov (obs = 10);
run;
```

Obs	_NAME_	_PARENT_	_NCL_	_FREQ_	_HEIGHT_	_RMSSTD_	_SPRSQ_	_RSQ_	_PSF_	_PST2_	_ERSQ_	_RATIO_	_LOGR_	_CC
1	RSM		103	0	0	0	0	1	.	.	.	.	.	
2	VT	CL102	103	944	0	0	0	1	.	.	.	.	.	
3	RC	CL102	103	355	0	0	0	1	.	.	.	.	.	
4	BN	CL101	103	60	0	0	0	1	.	.	.	.	.	
5	PO	CL101	103	67	0	0	0	1	.	.	.	.	.	
6	OR	CL100	103	186	0	0	0	1	.	.	.	.	.	
7	CN	CL100	103	1154	0	0	0	1	.	.	.	.	.	
8	VC	CL99	103	1644	0	0	0	1	.	.	.	.	.	
9	RA	CL99	103	1303	0	0	0	1	.	.	.	.	.	

Obs	_NAME_	_PARENT_	_NCL_	_FREQ_	_HEIGHT_	_RMSSTD_	_SPRSQ_	_RSQ_	_PSF_	_PST2_	_ERSQ_	_RATIO_	_LOGR_	_CC
10	EN	CL98	103	124	0	0	0	1	.	.	.	.	.	

Con 12 cluster arrivo a $R^2 \geq 0.99$

```
proc tree data = clusterprov nclusters = 12 out = prov12cl noprint;
    id prov;
    copy totespo totnsin totdannotot totfreqsin totdannomed;
run;

/* Assegno San Marino al cluster 12, che è quello con la frequenza sinistri più bassa */
data prov12cl;
  set prov12cl;
  if prov='RSM' then cluster=12;
run;

/* prov12cl contiene tante righe quante sono le province e indica di ogni provincia a quale cluster appartiene */
proc print data = prov12cl (obs = 10);
run;
```

Obs	Prov	totespo	totnsin	totdannotot	totfreqsin	totdannomed	CLUSTER	CLUSNAME
1	RSM	0.04	0	0.00	0.000	0.00	12	
2	VT	944.67	85	157469.91	0.090	1852.59	1	CL14
3	RC	355.66	32	68799.84	0.090	2150.00	1	CL14
4	BN	60.39	8	13033.78	0.132	1629.22	2	CL26
5	PO	67.96	9	24085.55	0.132	2676.17	2	CL26
6	OR	186.91	17	156203.33	0.091	9188.43	1	CL14
7	CN	1154.79	105	277702.80	0.091	2644.79	1	CL14
8	VC	1644.71	154	295996.92	0.094	1922.06	1	CL14
9	RA	1303.27	122	692249.43	0.094	5674.18	1	CL14
10	EN	124.29	12	15241.08	0.097	1270.09	3	CL20

```
/* polizzebyclusterprov contiene una riga per ogni cluster e indica di ogni cluster una serie di informazioni */
proc means data = prov12cl nway noprint;
    class cluster;
    var totespo totnsin totdannotot;
    output out = polizzebyclusterprov sum = totespocl totnsincl totdannototcl;
run;

data polizzebyclusterprov;
    set polizzebyclusterprov;

    totfreqsincl = totnsincl / totespocl;
    if totnsincl > 0 then totdannomedcl = totdannototcl / totnsincl;
        else totdannomedcl = 0;
    totqdcl = totdannototcl / totespocl;

    drop _type_;
    rename _FREQ_ = numprov;

    format totfreqsincl 5.3;
    format totespocl 10.2;
    format totdannototcl 10.2;
    format totqdcl 10.2;
run;

proc print data = polizzebyclusterprov;
run;
```

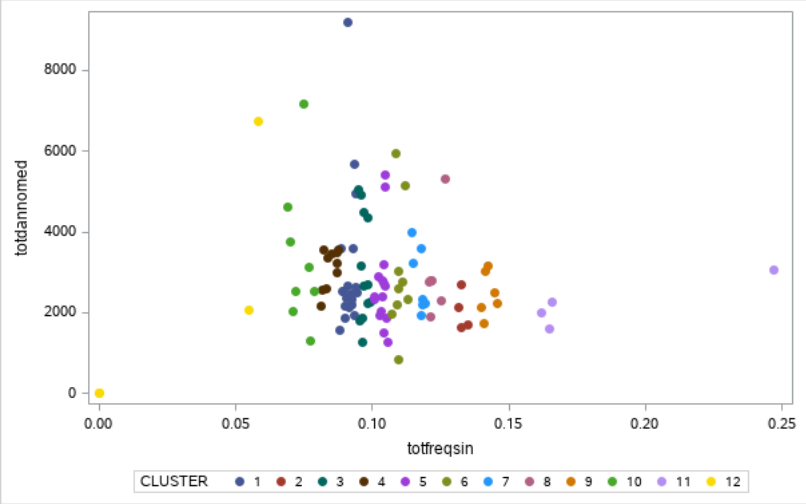
Obs	CLUSTER	numprov	totespocl	totnsincl	totdannototcl	totfreqsincl	totdannomedcl	totqdcl
1	1	19	21730.39	2002	5981240.95	0.092	2987.63	275.25
2	2	4	2158.09	289	537774.02	0.134	1860.81	249.19
3	3	12	12480.92	1215	3369680.21	0.097	2773.40	269.99
4	4	10	18644.35	1567	5068192.03	0.084	3234.33	271.84
5	5	15	15491.65	1603	5149935.33	0.103	3212.69	332.43
6	6	9	12556.48	1378	4973336.43	0.110	3609.10	396.08

Obs	CLUSTER	numprov	totespocl	totnsincl	totdannototcl	totfreqsincl	totdannomedcl	totqdcl
7	7	7	6464.18	758	2128488.68	0.117	2808.03	329.27
8	8	6	17521.58	2133	5941180.86	0.122	2785.36	339.08
9	9	6	3860.83	550	1377816.14	0.142	2505.12	356.87
10	10	8	7454.64	540	1906127.50	0.072	3529.87	255.70
11	11	4	3503.31	577	1237363.06	0.165	2144.48	353.20
12	12	4	1415.91	79	401864.78	0.056	5086.90	283.82

```
proc sort data = prov12cl;
    by cluster;
run;

/* Arricchisco il dataset prov12cl con le informazioni dei cluster a cui ogni provincia appartiene appartengono */
data prov12cl;
    merge prov12cl polizzebyclusterprov;
    by cluster;
run;

proc print data = prov12cl (obs = 10);
run;
```

Obs	Prov	totespo	totnsin	totdannotot	totfreqsin	totdannomed	CLUSTER	CLUSNAME	numprov	totespocl	totnsincl	totdannototcl	totf
1	VT	944.67	85	157469.91	0.090	1852.59	1	CL14	19	21730.39	2002	5981240.95	
2	RC	355.66	32	68799.84	0.090	2150.00	1	CL14	19	21730.39	2002	5981240.95	
3	OR	186.91	17	156203.33	0.091	9188.43	1	CL14	19	21730.39	2002	5981240.95	
4	CN	1154.79	105	277702.80	0.091	2644.79	1	CL14	19	21730.39	2002	5981240.95	
5	VC	1644.71	154	295996.92	0.094	1922.06	1	CL14	19	21730.39	2002	5981240.95	
6	RA	1303.27	122	692249.43	0.094	5674.18	1	CL14	19	21730.39	2002	5981240.95	
7	LC	119.11	11	24287.52	0.092	2207.96	1	CL14	19	21730.39	2002	5981240.95	
8	FE	964.48	89	207535.55	0.092	2331.86	1	CL14	19	21730.39	2002	5981240.95	
9	SS	531.54	47	169022.57	0.088	3596.22	1	CL14	19	21730.39	2002	5981240.95	
10	VV	11.36	1	1580.75	0.088	1580.75	1	CL14	19	21730.39	2002	5981240.95	

```
proc sgplot data = prov12cl;
    scatter x = totfreqsin y = totdannomed / group = cluster markerattrs=(symbol=CircleFilled);
run;
```



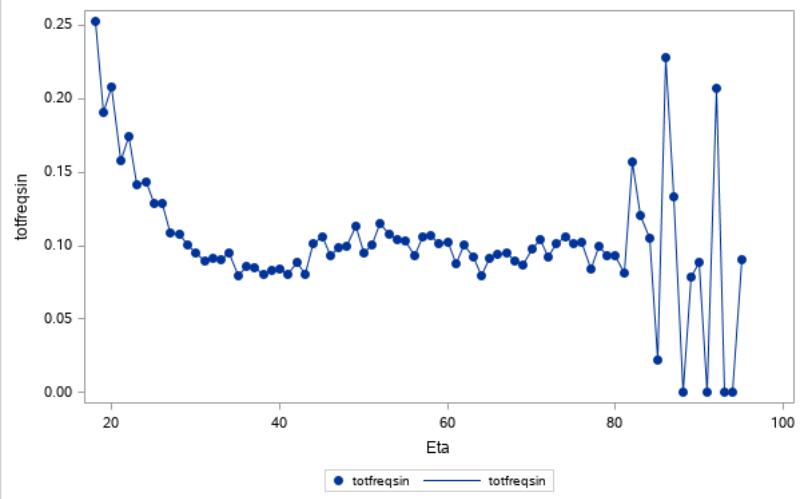
2.2. eta

```
proc means data = polizze nway noprint;
    class eta;
    var espo nsin dannotot;
    output out = polizzebyeta sum = totespo totnsin totdannotot;
run;
```

```
data polizzebyeta;
    set polizzebyeta;

    totfreqsin = totnsin/totespo;
    if totnsin>0 then totdannomed = totdannotot/totnsin;
        else totdannomed = 0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;
run;

proc print data = polizzebyeta (obs = 10) noobs;
    var eta totfreqsin totdannomed totqd totespo;
run;
```

Eta	totfreqsin	totdannomed	totqd	totespo
18	0.25271	2816.35	711.71	91.01
19	0.19048	6995.11	1332.43	593.24
20	0.20769	3387.97	703.64	1266.33
21	0.15775	3988.27	629.14	1939.81
22	0.17434	2767.00	482.41	2156.65
23	0.14105	4512.06	636.44	2566.41
24	0.14353	2912.02	417.98	2724.07
25	0.12885	3168.98	408.31	2832.83
26	0.12908	3389.06	437.45	2974.93
27	0.10822	2897.50	313.58	3132.37

```
proc sgplot data = polizzebyeta;
    scatter x = eta y = totfreqsin / markerattrs=(symbol=CircleFilled);
    series x = eta y = totfreqsin;
run;
```




```
/* Preraggruppamento */
proc format;
    value formateta
        low-22 = "18-22"
        23-24 = "23-24"
        25-26 = "25-26"
        27-30 = "27-30"
        31-34 = "31-34"
        35-43 = "35-43"
        44-51 = "44-51"
        52-60 = "52-60"
        61-64 = "61-64"
        65-69 = "65-69"
        70-81 = "70-81"
        82-high = "82-";
run;
```

```
data polizzebyeta;
    set polizzebyeta;
    leveleta = eta;
    format leveleta formateta.;
run;

/* Calcolo le informazioni a livello di ogni gruppo */
proc means data = polizzebyeta nway noprint;
    class leveleta;
    var eta totfreqsin;
    weight totespo;
    output out = polizzebyleveleta1 mean = etamed totfreqsinmed;
run;

proc means data = polizzebyeta nway noprint;
    class leveleta;
    var totespo totnsin totdannotot totnpol;
    output out = polizzebyleveleta2 sum = totespo totnsin totdannotot totnpol;
run;

data polizzebyleveleta;
    merge polizzebyleveleta1 polizzebyleveleta2;
    by leveleta;
    drop _type_ _freq_;
run;

/* Standardizzo eta e freqsin in modo da poterle usare assieme per l'accorpamento */
proc standard data = polizzebyleveleta out = polizzebyleveletastd mean = 0 std = 1;
    weight totespo;
    var etamed totfreqsinmed;
run;

data polizzebyleveletastd;
    set polizzebyleveletastd;
    format etamed 8.4;
    format totfreqsinmed 8.4;
run;

data polizzebyleveletastd;
    set polizzebyleveletastd;
    rename totfreqsinmed = totfreqsinmedstd;
    rename etamed = etamedstd;
run;

data polizzebyleveleta;
    merge polizzebyleveleta polizzebyleveletastd;
    by leveleta;
run;

proc print data = polizzebyleveleta;
run;
```

Obs	leveleta	etamed	totfreqsinmed	totespo	totnsin	totdannotot	totnpol	etamedstd	totfreqsinmedstd
1	18-22	21	0.17877	6047.04	1081	4007061.49	8991	-0.0144	0.0323
2	23-24	24	0.14233	5290.49	753	2771965.77	7542	-0.0127	0.0168
3	25-26	26	0.12897	5807.76	749	2458076.42	8292	-0.0113	0.0111
4	27-30	29	0.10288	13053.90	1343	4436387.56	18671	-0.0093	-0.0000
5	31-34	32	0.09152	12992.03	1189	2940408.97	18382	-0.0067	-0.0049
6	35-43	39	0.08305	25371.75	2107	6632792.66	35267	-0.0025	-0.0085
7	44-51	47	0.10100	20356.78	2056	5287609.56	28264	0.0031	-0.0008
8	52-60	56	0.10451	17873.66	1868	5358383.58	24606	0.0087	0.0007
9	61-64	62	0.09028	5781.94	522	1467871.43	7813	0.0131	-0.0054
10	65-69	67	0.09161	5414.12	496	1130324.59	7296	0.0160	-0.0048
11	70-81	73	0.09878	4899.85	484	1486592.19	6508	0.0203	-0.0018
12	82-	86	0.10941	393.00	43	95525.78	529	0.0284	0.0028

```
/* Effettuo il clustering usando sia etamedstd che totfreqsinmedstd */
proc cluster method = ward data = polizzebyleveleta outtree = clustereta;
    id leveleta;
    var etamedstd totfreqsinmedstd;
    freq totespo;
```

```
    copy totespo totnsin totdannotot etamed totfreqsinmed;
run;
```

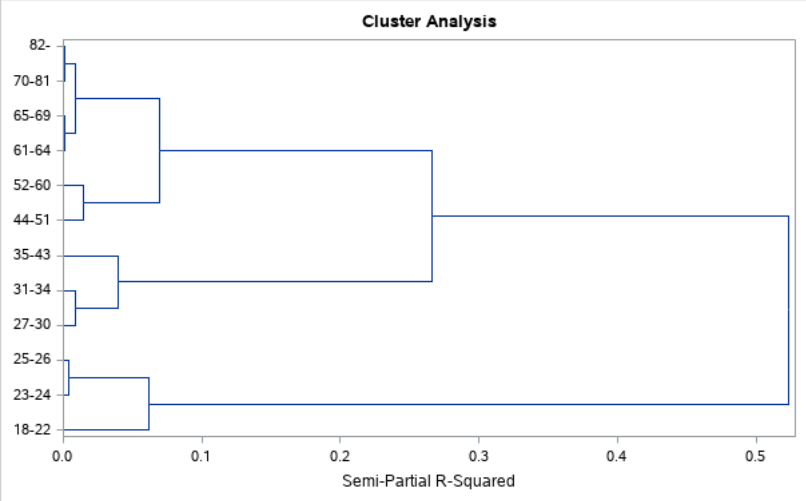
The CLUSTER Procedure
Ward's Minimum Variance Cluster Analysis

Eigenvalues of the Covariance Matrix				
	Eigenvalue	Difference	Proportion	Cumulative
1	0.00012676	0.00007507	0.7103	0.7103
2	0.00005169		0.2897	1.0000

Root-Mean-Square Total-Sample Standard Deviation	0.009446

Root-Mean-Square Distance Between Observations	0.018892

Cluster History						
Number of Clusters	Clusters Joined		Freq	Semipartial R-Square	R-Square	Tie
11	61-64	65-69	11195	0.0011	.999	
10	70-81	82-	5292	0.0014	.997	
9	23-24	25-26	11097	0.0043	.993	
8	27-30	31-34	26045	0.0089	.984	
7	CL11	CL10	16487	0.0090	.975	
6	44-51	52-60	38229	0.0145	.961	
5	CL8	35-43	51416	0.0394	.921	
4	18-22	CL9	17144	0.0621	.859	
3	CL6	CL7	54716	0.0694	.790	
2	CL5	CL3	106132	0.2665	.523	
1	CL4	CL2	123276	0.5234	.000	



Con 9 cluster arrivo a $R^2 \geq 0.99$

```
proc tree data = clustereta nclusters = 9 out = cluster9eta noprint;
    id leveleta;
    copy totespo totnsin totdannotot etamed totfreqsinmed;
run;

/* cluster9eta contiene tante righe quanti erano i cluster nel preraggruppamento manuale */
proc print data = cluster9eta;
run;
```

Obs	leveleta	totespo	totnsin	totdannotot	etamed	totfreqsinmed	CLUSTER	CLUSNAME
1	61-64	5781.94	522	1467871.43	62	0.09028	1	CL11
2	65-69	5414.12	496	1130324.59	67	0.09161	1	CL11
3	70-81	4899.85	484	1486592.19	73	0.09878	2	CL10
4	82-	393.00	43	95525.78	86	0.10941	2	CL10

Obs	leveleta	totespo	totnsin	totdannotot	etamed	totfreqsinmed	CLUSTER	CLUSNAME
5	23-24	5290.49	753	2771965.77	24	0.14233	3	CL9
6	25-26	5807.76	749	2458076.42	26	0.12897	3	CL9
7	27-30	13053.90	1343	4436387.56	29	0.10288	4	27-30
8	31-34	12992.03	1189	2940408.97	32	0.09152	5	31-34
9	44-51	20356.78	2056	5287609.56	47	0.10100	6	44-51
10	52-60	17873.66	1868	5358383.58	56	0.10451	7	52-60
11	35-43	25371.75	2107	6632792.66	39	0.08305	8	35-43
12	18-22	6047.04	1081	4007061.49	21	0.17877	9	18-22

```
/* polizzebyclustereta contiene una riga per ogni cluster e indica di ogni cluster una serie di informazioni */
proc means data = cluster9eta nway noprint;
    class cluster;
    var totespo totnsin totdannotot;
    output out = polizzebyclustereta sum = totespocl totnsincl totdannototcl;
run;

data polizzebyclustereta;
    set polizzebyclustereta;

    totfreqsincl = totnsincl/totespocl;
    if totnsincl>0 then totdannomedcl = totdannototcl/totnsincl;
        else totdannomedcl = 0;
    totqdcl = totdannototcl / totespocl;

    drop _type_;

    format totfreqsincl 5.3;
    format totespocl 10.2;
    format totdannototcl 10.2;
    format totqdcl 10.2;
run;

proc print data = polizzebyclustereta;
run;
```

Obs	CLUSTER	_FREQ_	totespocl	totnsincl	totdannototcl	totfreqsincl	totdannomedcl	totqdcl
1	1	2	11196.06	1018	2598196.02	0.091	2552.26	232.06
2	2	2	5292.85	527	1582117.97	0.100	3002.12	298.92
3	3	2	11098.25	1502	5230042.20	0.135	3482.05	471.25
4	4	1	13053.90	1343	4436387.56	0.103	3303.34	339.85
5	5	1	12992.03	1189	2940408.97	0.092	2473.01	226.32
6	6	1	20356.78	2056	5287609.56	0.101	2571.79	259.75
7	7	1	17873.66	1868	5358383.58	0.105	2868.51	299.79
8	8	1	25371.75	2107	6632792.66	0.083	3147.98	261.42
9	9	1	6047.04	1081	4007061.49	0.179	3706.81	662.65

```
proc sort data = cluster9eta;
    by cluster;
run;

/* Arricchisco il dataset cluster9eta con le informazioni dei cluster a cui ogni gruppo appartiene appartengono */
data cluster9eta;
    merge cluster9eta polizzebyclustereta;
    by cluster;
run;

proc print data = cluster9eta;
run;
```

Obs	leveleta	totespo	totnsin	totdannotot	etamed	totfreqsinmed	CLUSTER	CLUSNAME	_FREQ_	totespocl	totnsincl	totdannototcl	to
1	61-64	5781.94	522	1467871.43	62	0.09028	1	CL11	2	11196.06	1018	2598196.02	
2	65-69	5414.12	496	1130324.59	67	0.09161	1	CL11	2	11196.06	1018	2598196.02	
3	70-81	4899.85	484	1486592.19	73	0.09878	2	CL10	2	5292.85	527	1582117.97	

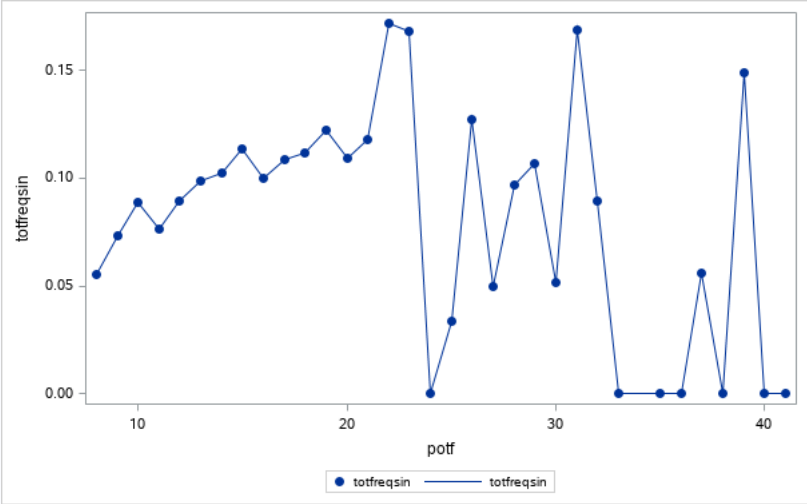
Obs	leveleta	totespo	totnsin	totdannotot	etamed	totfreqsinmed	CLUSTER	CLUSNAME	_FREQ_	totespocl	totnsincl	totdannototcl	to
4	82-	393.00	43	95525.78	86	0.10941	2	CL10	2	5292.85	527	1582117.97	
5	23-24	5290.49	753	2771965.77	24	0.14233	3	CL9	2	11098.25	1502	5230042.20	
6	25-26	5807.76	749	2458076.42	26	0.12897	3	CL9	2	11098.25	1502	5230042.20	
7	27-30	13053.90	1343	4436387.56	29	0.10288	4	27-30	1	13053.90	1343	4436387.56	
8	31-34	12992.03	1189	2940408.97	32	0.09152	5	31-34	1	12992.03	1189	2940408.97	
9	44-51	20356.78	2056	5287609.56	47	0.10100	6	44-51	1	20356.78	2056	5287609.56	
10	52-60	17873.66	1868	5358383.58	56	0.10451	7	52-60	1	17873.66	1868	5358383.58	
11	35-43	25371.75	2107	6632792.66	39	0.08305	8	35-43	1	25371.75	2107	6632792.66	
12	18-22	6047.04	1081	4007061.49	21	0.17877	9	18-22	1	6047.04	1081	4007061.49	

2.3 potf

```
proc means data = polizze nway noprint;
    class potf;
    var espo nsin dannotot;
    output out=polizzebypotf sum=totespo totnsin totdannotot;
run;

data polizzebypotf;
    set polizzebypotf;

    totfreqsin = totnsin / totespo;
    if totnsin > 0 then totdannomed = totdannotot / totnsin;
        else totdannomed = 0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;
run;

proc print data = polizzebypotf (obs = 10) noobs;
    var potf totfreqsin totdannomed totqd totespo;
run;
```

potf	totfreqsin	totdannomed	totqd	totespo
8	0.05539	1944.00	107.686	108.32
9	0.07350	2652.59	194.962	462.59
10	0.08866	2521.23	223.520	8798.13
11	0.07610	1693.54	128.886	604.43
12	0.08950	2387.18	213.641	23710.77
13	0.09886	2865.89	283.325	18773.85
14	0.10245	3726.90	381.824	9985.27
15	0.11341	2712.68	307.646	14425.51
16	0.09970	3201.22	319.150	6319.19
17	0.10883	3172.22	345.247	13543.50

```
proc sgplot data = polizzebypotf;
    scatter x = potf y = totfreqsin / markerattrs=(symbol=CircleFilled);
    series x = potf y = totfreqsin;
run;
```




```
/* Preraggruppamento */
proc format;
    value formatpotf
        low-13 = "8-13"
        14-15 = "14-15"
        16 = "16"
        17-21 = "17-21"
        22-23 = "22-23"
        24-26 = "24-26"
        27-28 = "27-28"
        29-30 = "29-30"
        31-high = "31-";
run;

data polizzebypotf;
    set polizzebypotf;
    levelpotf = potf;
    format levelpotf formatpotf.;
run;

/* Calcolo le informazioni a livello di ogni gruppo */
proc means data = polizzebypotf nway noprint;
    class levelpotf;
    var potf totfreqsin;
    weight totespo;
    output out = polizzebylevelpotf1 mean = potfmed totfreqsinmed;
run;

proc means data = polizzebypotf nway noprint;
    class levelpotf;
    var totespo totnsin totdannotot totnpol;
    output out = polizzebylevelpotf2 sum = totespo totnsin totdannotot totnpol;
run;

data polizzebylevelpotf;
    merge polizzebylevelpotf1 polizzebylevelpotf2;
    by levelpotf;
    drop _type_ _freq_;
run;

/* Standardizzo potf e freqsin in modo da poterle usare assieme per l'accorpamento */
proc standard data = polizzebylevelpotf out = polizzebylevelpotfstd mean = 0 std = 1;
    weight totespo;
    var potfmed totfreqsinmed;
run;

data polizzebylevelpotfstd;
    set polizzebylevelpotfstd;
    format potfmed 8.4;
    format totfreqsinmed 8.4;
run;

data polizzebylevelpotfstd;
    set polizzebylevelpotfstd;
    rename totfreqsinmed = totfreqsinmedstd;
    rename potfmed = potfmedstd;
run;

data polizzebylevelpotf;
```

```
    merge polizzebylevelpotf polizzebylevelpotfstd;
    by levelpotf;
run;

proc print data = polizzebylevelpotf;
run;
```

Obs	levelpotf	potfmed	totfreqsinmed	totespo	totnsin	totdannotot	totnpol	potfmedstd	totfreqsinmedstd
1	8-13	11.9762	0.09234	52458.09	4844	12530996.69	69752	-0.0078	-0.0072
2	14-15	14.5909	0.10893	24410.77	2659	8250561.58	33959	-0.0007	0.0040
3	16	16.0000	0.09970	6319.19	630	2016770.78	8812	0.0031	-0.0022
4	17-21	18.2424	0.11131	37795.14	4207	14159780.22	55913	0.0092	0.0057
5	22-23	22.8791	0.16838	1829.25	308	880999.10	2911	0.0217	0.0442
6	24-26	25.7794	0.10898	211.05	23	153340.75	350	0.0295	0.0041
7	27-28	27.5069	0.07383	40.63	3	32992.87	74	0.0342	-0.0197
8	29-30	29.5077	0.07867	114.40	9	31938.14	203	0.0396	-0.0164
9	31-	35.2581	0.07708	103.79	8	15619.88	187	0.0552	-0.0175

```
/* Effettuo il clustering usando sia potfmedstd che totfreqsinmedstd */
proc cluster method = ward data = polizzebylevelpotf outtree = clusterpotf;
    id levelpotf;
    var potfmedstd totfreqsinmedstd;
    freq totespo;
    copy totespo totnsin totdannotot potfmed totfreqsinmed;
run;
```

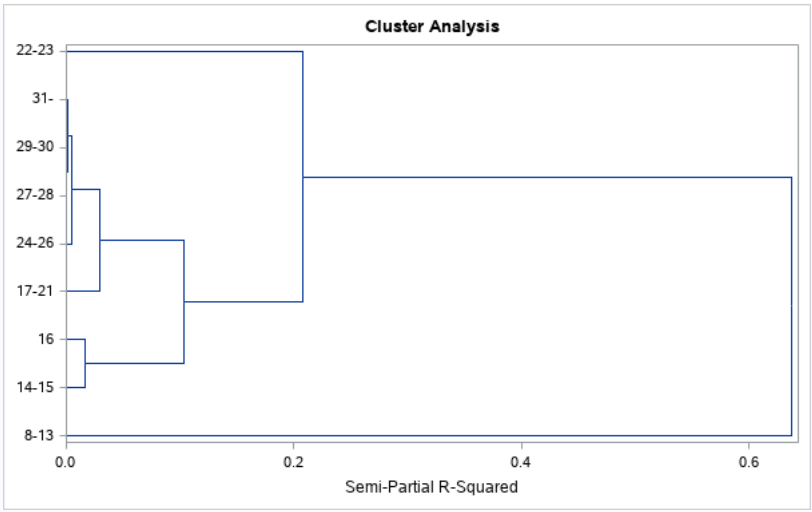
The CLUSTER Procedure
Ward's Minimum Variance Cluster Analysis

Eigenvalues of the Covariance Matrix				
	Eigenvalue	Difference	Proportion	Cumulative
1	0.00011638	0.00010301	0.8970	0.8970
2	0.00001337		0.1030	1.0000

Root-Mean-Square Total-Sample Standard Deviation	0.008054

Root-Mean-Square Distance Between Observations	0.016109

Cluster History						
Number of Clusters	Clusters Joined		Freq	Semipartial R-Square	R-Square	Tie
8	27-28	29-30	154	0.0001	1.00	
7	CL8	31-	257	0.0011	.999	
6	24-26	CL7	468	0.0051	.994	
5	14-15	16	30729	0.0168	.977	
4	17-21	CL6	38263	0.0292	.948	
3	CL5	CL4	68992	0.1028	.845	
2	CL3	22-23	70821	0.2078	.637	
1	8-13	CL2	123279	0.6371	.000	



Con 6 cluster arrivo a $R^2 \geq 0.99$

```
proc tree data = clusterpotf nclusters = 6 out = cluster6potf noprint;
    id levelpotf;
    copy totespo totnsin totdannotot potfmed totfreqsinmed;
run;

/* cluster6potf contiene tante righe quanti erano i cluster nel preraggruppamento manuale */
proc print data = cluster9eta;
run;
```

Obs	leveleta	totespo	totnsin	totdannotot	etamed	totfreqsinmed	CLUSTER	CLUSNAME	_FREQ_	totespocl	totnsincl	totdannototcl	to
1	61-64	5781.94	522	1467871.43	62	0.09028	1	CL11	2	11196.06	1018	2598196.02	
2	65-69	5414.12	496	1130324.59	67	0.09161	1	CL11	2	11196.06	1018	2598196.02	
3	70-81	4899.85	484	1486592.19	73	0.09878	2	CL10	2	5292.85	527	1582117.97	
4	82-	393.00	43	95525.78	86	0.10941	2	CL10	2	5292.85	527	1582117.97	
5	23-24	5290.49	753	2771965.77	24	0.14233	3	CL9	2	11098.25	1502	5230042.20	
6	25-26	5807.76	749	2458076.42	26	0.12897	3	CL9	2	11098.25	1502	5230042.20	
7	27-30	13053.90	1343	4436387.56	29	0.10288	4	27-30	1	13053.90	1343	4436387.56	
8	31-34	12992.03	1189	2940408.97	32	0.09152	5	31-34	1	12992.03	1189	2940408.97	
9	44-51	20356.78	2056	5287609.56	47	0.10100	6	44-51	1	20356.78	2056	5287609.56	
10	52-60	17873.66	1868	5358383.58	56	0.10451	7	52-60	1	17873.66	1868	5358383.58	
11	35-43	25371.75	2107	6632792.66	39	0.08305	8	35-43	1	25371.75	2107	6632792.66	
12	18-22	6047.04	1081	4007061.49	21	0.17877	9	18-22	1	6047.04	1081	4007061.49	

```
/* polizzebyclusterpotf contiene una riga per ogni cluster e indica di ogni cluster una serie di informazioni */
proc means data = cluster6potf nway noprint;
    class cluster;
    var totespo totnsin totdannotot;
    output out = polizzebyclusterpotf sum = totespocl totnsincl totdannototcl;
run;

data polizzebyclusterpotf;
    set polizzebyclusterpotf;

    totfreqsincl = totnsincl / totespocl;
    if totnsincl > 0 then totdannomedcl = totdannototcl / totnsincl;
        else totdannomedcl = 0;
    totqdcl = totdannototcl / totespocl;

    drop _type_;

    format totfreqsincl 5.3;
    format totespocl 10.2;
    format totdannototcl 10.2;
    format totqdcl 10.2;
run;

proc print data = polizzebyclusterpotf;
run;
```

Obs	CLUSTER	_FREQ_	totespocl	totnsincl	totdannototcl	totfreqsincl	totdannomedcl	totqdcl
1	1	4	469.88	43	233891.63	0.092	5439.34	497.77
2	2	1	24410.77	2659	8250561.58	0.109	3102.88	337.99
3	3	1	6319.19	630	2016770.78	0.100	3201.22	319.15
4	4	1	37795.14	4207	14159780.2	0.111	3365.77	374.65
5	5	1	1829.25	308	880999.10	0.168	2860.39	481.62
6	6	1	52458.09	4844	12530996.7	0.092	2586.91	238.88

```
proc sort data = cluster6potf;
    by cluster;
run;

/* Arricchisco il dataset cluster9eta con le informazioni dei cluster a cui ogni gruppo appartiene appartengono */
data cluster6potf;
    merge cluster6potf polizzeby clusterpotf;
    by cluster;
run;

proc print data = cluster6potf;
run;
```

Obs	levelpotf	totespo	totnsin	totdannotot	potfmed	totfreqsinmed	CLUSTER	CLUSNAME	_FREQ_	totespocl	totnsincl	totdannototcl
1	27-28	40.63	3	32992.87	27.5069	0.07383	1	CL6	4	469.88	43	233891.63
2	29-30	114.40	9	31938.14	29.5077	0.07867	1	CL6	4	469.88	43	233891.63
3	31-	103.79	8	15619.88	35.2581	0.07708	1	CL6	4	469.88	43	233891.63
4	24-26	211.05	23	153340.75	25.7794	0.10898	1	CL6	4	469.88	43	233891.63
5	14-15	24410.77	2659	8250561.58	14.5909	0.10893	2	14-15	1	24410.77	2659	8250561.58
6	16	6319.19	630	2016770.78	16.0000	0.09970	3	16	1	6319.19	630	2016770.78
7	17-21	37795.14	4207	14159780.22	18.2424	0.11131	4	17-21	1	37795.14	4207	14159780.2
8	22-23	1829.25	308	880999.10	22.8791	0.16838	5	22-23	1	1829.25	308	880999.10
9	8-13	52458.09	4844	12530996.69	11.9762	0.09234	6	8-13	1	52458.09	4844	12530996.7

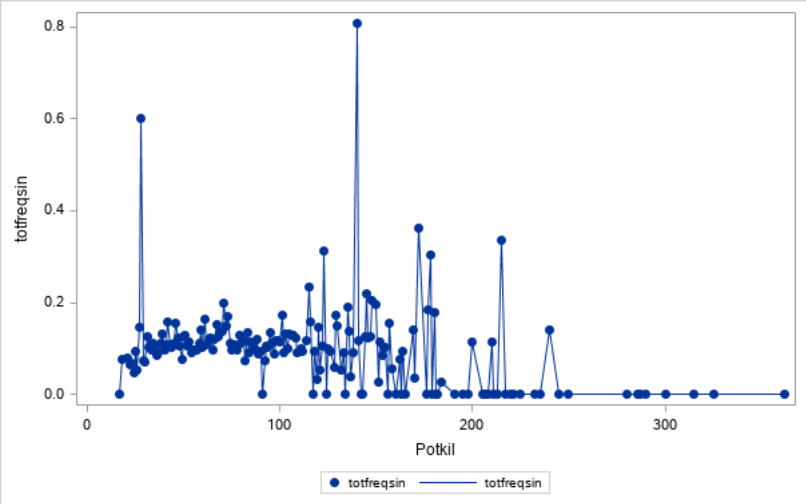
2.4 potkil

```
proc means data = polizze nway noprint;
    class potkil;
    var espo nsin dannotot;
    output out = polizzebypotkil sum = totespo totnsin totdannotot;
run;

data polizzebypotkil;
    set polizzebypotkil;

    totfreqsin = totnsin / totespo;
    if totnsin > 0 then totdannomed = totdannotot / totnsin;
        else totdannomed = 0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;
run;

proc print data = polizzebypotkil (obs = 10) noobs;
    var potkil totfreqsin totdannomed totqd totespo;
run;
```

Potkil	totfreqsin	totdannomed	totqd	totespo
17	0.00000	0.00	0.000	1.00
18	0.07744	1962.64	151.979	761.92
21	0.07948	1004.69	79.857	50.32
22	0.06481	2123.15	137.611	1388.58
23	0.06825	2928.59	199.878	424.90

Potkil	totfreqsin	totdannomed	totqd	totespo
24	0.04795	1232.91	59.115	166.85
25	0.09376	2565.60	240.549	7231.26
26	0.05409	1834.78	99.243	110.93
27	0.14576	1629.22	237.483	54.88
28	0.60132	1617.55	972.671	1.66

```
proc sgplot data = polizzebypotkil;
    scatter x = potkil y = totfreqsin / markerattrs=(symbol=CircleFilled);
    series x = potkil y = totfreqsin;
run;
```




```
/* Preraggruppamento */
proc format;
    value formatpotkil
        low-26 = "17-26"
        27-33 = "27-33"
        34-39 = "34-39"
        40-49 = "40-49"
        50-57 = "50-57"
        58-65 = "58-65"
        66-78 = "66-78"
        79-92 = "79-92"
        93-108 = "93-108"
        109-123 = "109-123"
        124-139 = "124-139"
        140-143 = "140-143"
        144-150 = "144-150"
        151-high = "151-";
run;

data polizzebypotkil;
    set polizzebypotkil;
    levelpotkil = potkil;
    format levelpotkil formatpotkil.;
run;

/* Calcolo le informazioni a livello di ogni gruppo */
proc means data = polizzebypotkil nway noprint;
    class levelpotkil;
    var potkil totfreqsin;
    weight totespo;
    output out = polizzebylevelpotkil1 mean = potkilmed totfreqsinmed;
run;

proc means data = polizzebypotkil nway noprint;
    class levelpotkil;
    var totespo totnsin totdannotot totnpol;
    output out = polizzebylevelpotkil2 sum = totespo totnsin totdannotot totnpol;
run;

data polizzebylevelpotkil;
    merge polizzebylevelpotkil1 polizzebylevelpotkil2;
```

```
    by levelpotkil;
    drop _type_ _freq_;
run;

/* Standardizzo potkil e freqsin in modo da poterle usare assieme per l'accorpamento */
proc standard data = polizzebylevelpotkil out = polizzebylevelpotkilstd mean = 0 std = 1;
    weight totespo;
    var potkilmed totfreqsinmed;
run;

data polizzebylevelpotkilstd;
    set polizzebylevelpotkilstd;;
    format potkilmed 8.4;
    format totfreqsinmed 8.4;
run;

data polizzebylevelpotkilstd;
    set polizzebylevelpotkilstd;
    rename totfreqsinmed = totfreqsinmedstd;
    rename potkilmed = potkilmedstd;
run;

data polizzebylevelpotkil;
    merge polizzebylevelpotkil polizzebylevelpotkilstd;
    by levelpotkil;
run;

proc print data = polizzebylevelpotkil;
run;
```

Obs	levelpotkil	potkilmed	totfreqsinmed	totespo	totnsin	totdannotot	totnpol	potkilmedstd	totfreqsinmedstd
1	17-26	24	0.08623	10135.77	874	2156174.24	12869	-0.0122	-0.0182
2	27-33	32	0.09524	25850.67	2462	6016100.65	33836	-0.0085	-0.0084
3	34-39	37	0.09485	8866.64	841	2349060.15	11897	-0.0066	-0.0088
4	40-49	42	0.10566	21947.98	2319	6765891.74	30871	-0.0042	0.0029
5	50-57	54	0.10234	18468.22	1890	6129883.56	26263	0.0011	-0.0007
6	58-65	63	0.11136	8961.77	998	2819251.65	12396	0.0049	0.0091
7	66-78	70	0.11802	13294.86	1569	5232526.19	19805	0.0084	0.0164
8	79-92	84	0.10980	8551.79	939	3712429.07	12715	0.0146	0.0074
9	93-108	100	0.11632	4556.23	530	1947041.86	7146	0.0215	0.0145
10	109-123	113	0.10033	1335.57	134	394231.62	2114	0.0275	-0.0028
11	124-139	133	0.10190	510.29	52	201130.36	827	0.0361	-0.0011
12	140-143	141	0.14247	42.11	6	8233.18	71	0.0397	0.0429
13	144-150	147	0.15611	224.20	35	144582.22	393	0.0422	0.0577
14	151-	176	0.07833	536.23	42	196463.52	958	0.0551	-0.0267

```
/* Effettuo il clustering usando sia potkilmedstd che totfreqsinmedstd */
proc cluster method = ward data = polizzebylevelpotkil outtree = clusterpotkil;
    id levelpotkil;
    var potkilmedstd totfreqsinmedstd;
    freq totespo;
    copy totespo totnsin totdannotot potkilmed totfreqsinmed;
run;
```

The CLUSTER Procedure
Ward's Minimum Variance Cluster Analysis

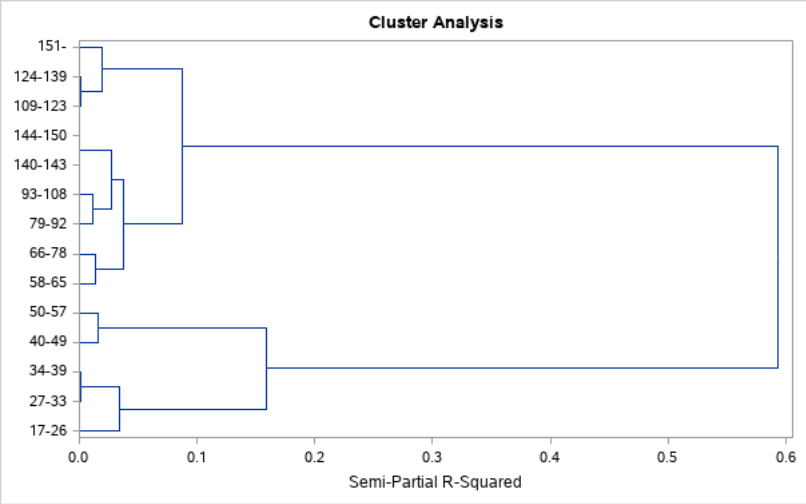
Eigenvalues of the Covariance Matrix				
	Eigenvalue	Difference	Proportion	Cumulative
1	0.00017512	0.00013937	0.8305	0.8305
2	0.00003575		0.1695	1.0000

Root-Mean-Square Total-Sample Standard Deviation	0.010268

Root-Mean-Square Distance Between Observations	0.020537

Cluster History

Number of Clusters	Cluster History		Freq	Semipartial R-Square	R-Square	Tie
	Clusters Joined					
13	140-143	144-150	266	0.0003	1.00	
12	27-33	34-39	34716	0.0010	.999	
11	109-123	124-139	1845	0.0011	.998	
10	79-92	93-108	13107	0.0112	.986	
9	58-65	66-78	22255	0.0132	.973	
8	40-49	50-57	40415	0.0156	.958	
7	CL11	151-	2381	0.0196	.938	
6	CL10	CL13	13373	0.0269	.911	
5	17-26	CL12	44851	0.0337	.877	
4	CL9	CL6	35628	0.0378	.840	
3	CL4	CL7	38009	0.0874	.752	
2	CL5	CL8	85266	0.1589	.593	
1	CL2	CL3	123275	0.5932	.000	



Con 11 cluster arrivo a $R^2 \geq 0.99$

```
proc tree data = clusterpotkil nclusters = 11 out = cluster11potkil noprint;
    id levelpotkil;
    copy totespo totnsin totdannotot potkilmed totfreqsinmed;
run;

/* cluster11potkil contiene tante righe quanti erano i cluster nel preraggruppamento manuale */
proc print data = cluster11potkil;
run;
```

Obs	levelpotkil	totespo	totnsin	totdannotot	potkilmed	totfreqsinmed	CLUSTER	CLUSNAME
1	140-143	42.11	6	8233.18	141	0.14247	1	CL13
2	144-150	224.20	35	144582.22	147	0.15611	1	CL13
3	27-33	25850.67	2462	6016100.65	32	0.09524	2	CL12
4	34-39	8866.64	841	2349060.15	37	0.09485	2	CL12
5	109-123	1335.57	134	394231.62	113	0.10033	3	CL11
6	124-139	510.29	52	201130.36	133	0.10190	3	CL11
7	79-92	8551.79	939	3712429.07	84	0.10980	4	79-92
8	93-108	4556.23	530	1947041.86	100	0.11632	5	93-108
9	58-65	8961.77	998	2819251.65	63	0.11136	6	58-65
10	66-78	13294.86	1569	5232526.19	70	0.11802	7	66-78
11	40-49	21947.98	2319	6765891.74	42	0.10566	8	40-49
12	50-57	18468.22	1890	6129883.56	54	0.10234	9	50-57
13	151-	536.23	42	196463.52	176	0.07833	10	151-
14	17-26	10135.77	874	2156174.24	24	0.08623	11	17-26

```
/* polizzebyclusterpotkil contiene una riga per ogni cluster e indica di ogni cluster una serie di informazioni */
proc means data = cluster11potkil nway noprint;
    class cluster;
    var totespo totnsin totdannotot;
    output out = polizzebyclusterpotkil sum = totespocl totnsincl totdannototcl;
run;

data polizzebyclusterpotkil;
    set polizzebyclusterpotkil;

    totfreqsincl = totnsincl/totespocl;
    if totnsincl > 0 then totdannomedcl = totdannototcl / totnsincl;
        else totdannomedcl = 0;
    totqdcl = totdannototcl / totespocl;

    drop _type_;

    format totfreqsincl 5.3;
    format totespocl 10.2;
    format totdannototcl 10.2;
    format totqdcl 10.2;
run;

proc print data = polizzebyclusterpotkil;
run;
```

Obs	CLUSTER	_FREQ_	totespocl	totnsincl	totdannototcl	totfreqsincl	totdannomedcl	totqdcl
1	1	2	266.31	41	152815.40	0.154	3727.20	573.82
2	2	2	34717.32	3303	8365160.80	0.095	2532.59	240.95
3	3	2	1845.86	186	595361.98	0.101	3200.87	322.54
4	4	1	8551.79	939	3712429.07	0.110	3953.60	434.11
5	5	1	4556.23	530	1947041.86	0.116	3673.66	427.34
6	6	1	8961.77	998	2819251.65	0.111	2824.90	314.59
7	7	1	13294.86	1569	5232526.19	0.118	3334.94	393.58
8	8	1	21947.98	2319	6765891.74	0.106	2917.59	308.27
9	9	1	18468.22	1890	6129883.56	0.102	3243.32	331.92
10	10	1	536.23	42	196463.52	0.078	4677.70	366.38
11	11	1	10135.77	874	2156174.24	0.086	2467.02	212.73

```
proc sort data = cluster11potkil;
    by cluster;
run;

/* Arricchisco il dataset cluster11potkil con le informazioni dei cluster a cui ogni gruppo appartiene appartengono */
data cluster11potkil;
    merge cluster11potkil polizzebyclusterpotkil;
    by cluster;
run;

proc print data = cluster11potkil;
run;
```

Obs	levelpotkil	totespo	totnsin	totdannotot	potkilmed	totfreqsinmed	CLUSTER	CLUSNAME	_FREQ_	totespocl	totnsincl	totdannototc
1	140-143	42.11	6	8233.18	141	0.14247	1	CL13	2	266.31	41	152815.40
2	144-150	224.20	35	144582.22	147	0.15611	1	CL13	2	266.31	41	152815.40
3	27-33	25850.67	2462	6016100.65	32	0.09524	2	CL12	2	34717.32	3303	8365160.80
4	34-39	8866.64	841	2349060.15	37	0.09485	2	CL12	2	34717.32	3303	8365160.80
5	109-123	1335.57	134	394231.62	113	0.10033	3	CL11	2	1845.86	186	595361.98
6	124-139	510.29	52	201130.36	133	0.10190	3	CL11	2	1845.86	186	595361.98
7	79-92	8551.79	939	3712429.07	84	0.10980	4	79-92	1	8551.79	939	3712429.07
8	93-108	4556.23	530	1947041.86	100	0.11632	5	93-108	1	4556.23	530	1947041.86
9	58-65	8961.77	998	2819251.65	63	0.11136	6	58-65	1	8961.77	998	2819251.65
10	66-78	13294.86	1569	5232526.19	70	0.11802	7	66-78	1	13294.86	1569	5232526.19
11	40-49	21947.98	2319	6765891.74	42	0.10566	8	40-49	1	21947.98	2319	6765891.74

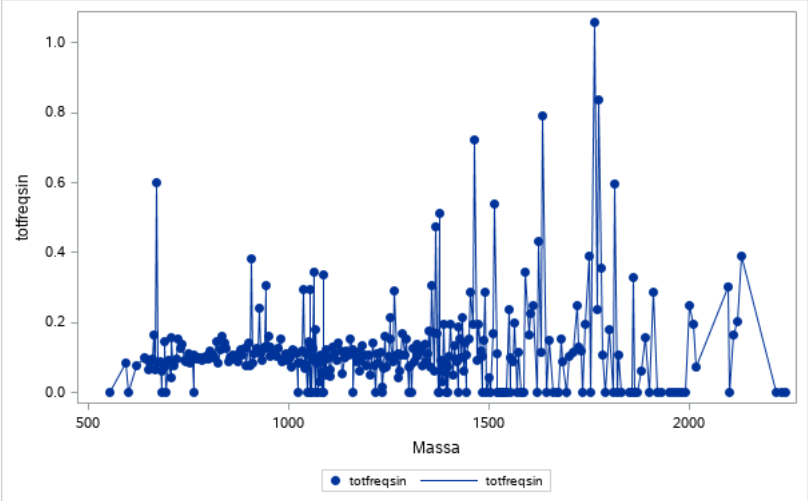
Obs	levelpotkil	totespo	totnsin	totdannotot	potkilmed	totfreqsinmed	CLUSTER	CLUSNAME	_FREQ_	totespocl	totnsincl	totdannototc
12	50-57	18468.22	1890	6129883.56	54	0.10234	9	50-57	1	18468.22	1890	6129883.56
13	151-	536.23	42	196463.52	176	0.07833	10	151-	1	536.23	42	196463.52
14	17-26	10135.77	874	2156174.24	24	0.08623	11	17-26	1	10135.77	874	2156174.24

2.5 massa

```
proc means data = polizze nway noprint;
    class massa;
    var espo nsin dannotot;
    output out = polizzebymassa sum = totespo totnsin totdannotot;
run;

data polizzebymassa;
    set polizzebymassa;

    totfreqsin = totnsin / totespo;
    if totnsin > 0 then totdannomed = totdannotot / totnsin;
        else totdannomed = 0;
    totqd = totdannotot / totespo;

    drop _TYPE_;
    rename _FREQ_ = totnpol;
run;

proc print data = polizzebymassa (obs = 10) noobs;
    var massa totfreqsin totdannomed totqd totespo;
run;
```

Massa	totfreqsin	totdannomed	totqd	totespo
555	0.00000	0.00	0.000	3.293
595	0.08505	1004.69	85.449	47.031
600	0.00000	0.00	0.000	1.000
620	0.07744	1962.64	151.979	761.919
640	0.10040	2535.30	254.545	597.609
645	0.09502	3869.34	367.668	210.480
650	0.06461	2292.56	148.115	386.957
655	0.08441	2658.69	224.424	485.715
660	0.09553	4501.34	430.005	83.745
665	0.16397	1850.27	303.397	12.197

```
proc sgplot data = polizzebymassa;
    scatter x = massa y = totfreqsin / markerattrs=(symbol=CircleFilled);
    series x = massa y = totfreqsin;
run;
```



```
/* Preraggruppamento */
proc format;
    value formatmassa
        low-691 = "555-691"
        692-720 = "692-720"
        721-800 = "721-800"
        801-905 = "801-905"
        906-980 = "906-980"
        981-1030 = "981-1030"
        1031-1094 = "1031-1094"
        1095-1269 = "1095-1269"
        1270-1379 = "1270-1379"
        1380-1424 = "1380-1424"
        1425-1520 = "1425-1520"
        1521-high = "1521-";
run;

data polizzebymassa;
    set polizzebymassa;
    levelmassa = massa;
    format levelmassa formatmassa.;
run;

/* Calcolo le informazioni a livello di ogni gruppo */
proc means data = polizzebymassa nway noprint;
    class levelmassa;
    var massa totfreqsin;
    weight totespo;
    output out = polizzebylevelmassa1 mean = massamed totfreqsinmed;
run;

proc means data = polizzebymassa nway noprint;
    class levelmassa;
    var totespo totnsin totdannotot totnpol;
    output out = polizzebylevelmassa2 sum = totespo totnsin totdannotot totnpol;
run;

data polizzebylevelmassa;
    merge polizzebylevelmassa1 polizzebylevelmassa2;
    by levelmassa;
    drop _type_ _freq_;
run;

/* Standardizzo massa e freqsin in modo da poterle usare assieme per l'accorpamento */
proc standard data = polizzebylevelmassa out = polizzebylevelmassastd mean = 0 std = 1;
    weight totespo;
    var massamed totfreqsinmed;
run;

data polizzebylevelmassastd;
    set polizzebylevelmassastd;
    rename totfreqsinmed = totfreqsinmedstd;
    rename massamed = massamedstd;
run;

data polizzebylevelmassa;
    merge polizzebylevelmassa polizzebylevelmassastd;
    by levelmassa;
run;

proc print data = polizzebylevelmassastd;
run;
```

Obs	levelmassa	massamedstd	totfreqsinmedstd	totespo	totnsin	totdannotot	totnpol
1	555-691	-0	-0.020622	5521.44	451	1061529.72	7300
2	692-720	-0	-0.012126	16065.77	1453	3658464.65	20597
3	721-800	-0	-0.004167	26549.50	2619	7429810.95	35149
4	801-905	-0	0.006782	19165.92	2107	5922241.99	27196
5	906-980	0	0.011072	12906.82	1476	5335631.45	18596
6	981-1030	0	-0.001131	11711.90	1192	3311423.85	16285
7	1031-1094	0	-0.001358	7287.62	740	1931281.76	10485
8	1095-1269	0	0.004669	16323.80	1759	6695084.72	24090
9	1270-1379	0	0.008103	4483.50	499	1539118.74	7006
10	1380-1424	0	-0.014131	1052.35	93	327804.52	1706

Obs	levelmassa	massamedstd	totfreqsinmedstd	totespo	totnsin	totdannotot	totnpol
11	1425-1520	0	0.026959	1499.20	196	581444.16	2531
12	1521-	0	0.044047	714.50	106	279163.49	1220

```
/* Effettuo il clustering usando sia massamedstd che totfreqsinmedstd */
proc cluster method = ward data = polizzebylevelmassa outtree = clustermassa;
    id levelmassa;
    var massamedstd totfreqsinmedstd;
    freq totespo;
    copy totespo totnsin totdannotot massamed totfreqsinmed;
run;
```

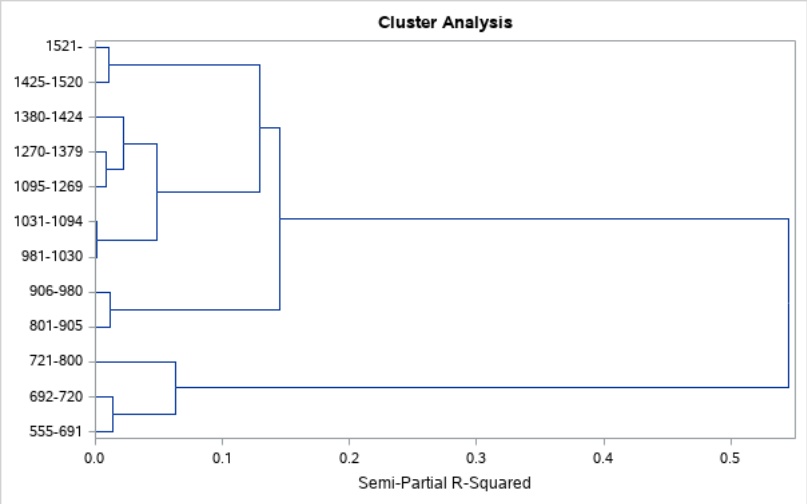
The CLUSTER Procedure
Ward's Minimum Variance Cluster Analysis

Eigenvalues of the Covariance Matrix				
	Eigenvalue	Difference	Proportion	Cumulative
1	0.00014846	0.00011849	0.8320	0.8320
2	0.00002998		0.1680	1.0000

Root-Mean-Square Total-Sample Standard Deviation	0.009446

Root-Mean-Square Distance Between Observations	0.018891

Cluster History						
Number of Clusters	Clusters Joined		Freq	Semipartial R-Square	R-Square	Tie
11	981-1030	1031-1094	18998	0.0016	.998	
10	1095-1269	1270-1379	20806	0.0083	.990	
9	1425-1520	1521-	2213	0.0108	.979	
8	801-905	906-980	32071	0.0114	.968	
7	555-691	692-720	21586	0.0143	.954	
6	CL10	1380-1424	21858	0.0217	.932	
5	CL11	CL6	40856	0.0490	.883	
4	CL7	721-800	48135	0.0627	.820	
3	CL5	CL9	43069	0.1295	.691	
2	CL8	CL3	75140	0.1453	.545	
1	CL4	CL2	123275	0.5455	.000	



Con 10 cluster arrivo a $R^2 \geq 0.99$

```
proc tree data = clustermassa nclusters = 10 out = cluster10massa noprint;
    id levelmassa;
    copy totespo totnsin totdannotot massamed totfreqsinmed;
run;
```

```
/* cluster10massa contiene tante righe quanti erano i cluster nel preraggruppamento manuale */
proc print data = cluster10massa;
run;
```

Obs	levelmassa	totespo	totnsin	totdannotot	massamed	totfreqsinmed	CLUSTER	CLUSNAME
1	981-1030	11711.90	1192	3311423.85	1007	0.10178	1	CL11
2	1031-1094	7287.62	740	1931281.76	1065	0.10154	1	CL11
3	1095-1269	16323.80	1759	6695084.72	1171	0.10776	2	CL10
4	1270-1379	4483.50	499	1539118.74	1303	0.11130	2	CL10
5	1425-1520	1499.20	196	581444.16	1459	0.13074	3	1425-1520
6	1521-	714.50	106	279163.49	1757	0.14835	4	1521-
7	801-905	19165.92	2107	5922241.99	860	0.10993	5	801-905
8	906-980	12906.82	1476	5335631.45	939	0.11436	6	906-980
9	555-691	5521.44	451	1061529.72	663	0.08168	7	555-691
10	692-720	16065.77	1453	3658464.65	706	0.09044	8	692-720
11	1380-1424	1052.35	93	327804.52	1404	0.08837	9	1380-1424
12	721-800	26549.50	2619	7429810.95	772	0.09865	10	721-800

```
/* polizzebyclustereta contiene una riga per ogni cluster e indica di ogni cluster una serie di informazioni */
proc means data = cluster10massa nway noprint;
    class cluster;
    var totespo totnsin totdannotot;
    output out = polizzebyclustermassa sum = totespocl totnsincl totdannototcl;
run;

data polizzebyclustermassa;
    set polizzebyclustermassa;

    totfreqsincl = totnsincl / totespocl;
    if totnsincl > 0 then totdannomedcl = totdannototcl / totnsincl;
        else totdannomedcl = 0;
    totqdcl = totdannototcl / totespocl;

    drop _type_;

    format totfreqsincl 5.3;
    format totespocl 10.2;
    format totdannototcl 10.2;
    format totqdcl 10.2;
run;

proc print data = polizzebyclustermassa;
run;
```

Obs	CLUSTER	_FREQ_	totespocl	totnsincl	totdannototcl	totfreqsincl	totdannomedcl	totqdcl
1	1	2	18999.52	1932	5242705.61	0.102	2713.62	275.94
2	2	2	20807.30	2258	8234203.46	0.109	3646.68	395.74
3	3	1	1499.20	196	581444.16	0.131	2966.55	387.84
4	4	1	714.50	106	279163.49	0.148	2633.62	390.71
5	5	1	19165.92	2107	5922241.99	0.110	2810.75	309.00
6	6	1	12906.82	1476	5335631.45	0.114	3614.93	413.40
7	7	1	5521.44	451	1061529.72	0.082	2353.72	192.26
8	8	1	16065.77	1453	3658464.65	0.090	2517.87	227.72
9	9	1	1052.35	93	327804.52	0.088	3524.78	311.50
10	10	1	26549.50	2619	7429810.95	0.099	2836.89	279.85

```
proc sort data = cluster10massa;
    by cluster;
run;

/* Arricchisco il dataset cluster9eta con le informazioni dei cluster a cui ogni gruppo appartiene appartengono */
data cluster10massa;
    merge cluster10massa polizzebyclustermassa;
```

```
    by cluster;
run;

proc print data = cluster10massa;
run;
```

Obs	levelmassa	totespo	totnsin	totdannotot	massamed	totfreqsinmed	CLUSTER	CLUSNAME	_FREQ_	totespocl	totnsincl	totdannoto
1	981-1030	11711.90	1192	3311423.85	1007	0.10178	1	CL11	2	18999.52	1932	5242705.
2	1031-1094	7287.62	740	1931281.76	1065	0.10154	1	CL11	2	18999.52	1932	5242705.
3	1095-1269	16323.80	1759	6695084.72	1171	0.10776	2	CL10	2	20807.30	2258	8234203.
4	1270-1379	4483.50	499	1539118.74	1303	0.11130	2	CL10	2	20807.30	2258	8234203.
5	1425-1520	1499.20	196	581444.16	1459	0.13074	3	1425-1520	1	1499.20	196	581444.
6	1521-	714.50	106	279163.49	1757	0.14835	4	1521-	1	714.50	106	279163.
7	801-905	19165.92	2107	5922241.99	860	0.10993	5	801-905	1	19165.92	2107	5922241.
8	906-980	12906.82	1476	5335631.45	939	0.11436	6	906-980	1	12906.82	1476	5335631.
9	555-691	5521.44	451	1061529.72	663	0.08168	7	555-691	1	5521.44	451	1061529.
10	692-720	16065.77	1453	3658464.65	706	0.09044	8	692-720	1	16065.77	1453	3658464.
11	1380-1424	1052.35	93	327804.52	1404	0.08837	9	1380-1424	1	1052.35	93	327804.
12	721-800	26549.50	2619	7429810.95	772	0.09865	10	721-800	1	26549.50	2619	7429810.

Assegnazione formati

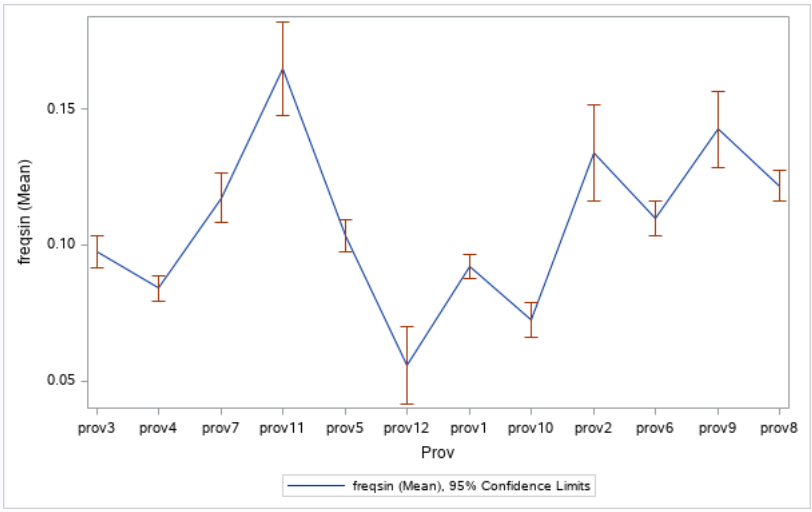
```
/* prov */
proc format;
    value $classprov
        "RC","VT","CN","OR","RA","VC","FE","LC","SS","VV","BZ","PV","RG","CH","PG","AR","TE","TN","VR" = "prov1"
        "BN","PO","IM","BA" = "prov2"
        "EN","NO","SV","VI","MC","MT","RE","BS","RI","AG","AV","PC" = "prov3"
        "AL","SO","GO","LT","PR","PN","GR","UD","TV","PD" = "prov4"
        "SI","TR","AP","LO","FG","ME","LU","CZ","FR","CT","VE","BG","IS","MO","TP" = "prov5"
        "CL","PI","VA","BR","FO","LI","SR","CO","SA" = "prov6"
        "LE","RN","AN","MS","BO","GE","TS" = "prov7"
        "CB","FI","NU","PE","TO","MI" = "prov8"
        "PT","TA","SP","CA","ROMA","PA" = "prov9"
        "BL","PZ","BI","CR","CS","AT","MN","PS" = "prov10"
        "AO","NA","CE","KR" = "prov11"
        "AQ","RSM","VB","RO" = "prov12";
run;

/* eta */
proc format;
    value classeta
        low-22 = "18-22"
        23-26 = "23-26"
        27-30 = "27-30"
        31-34 = "31-34"
        35-43 = "35-43"
        44-51 = "44-51"
        52-60 = "52-60"
        61-69 = "61-69"
        70-high = "70-";
run;

/* potf */
proc format;
    value classpotf
        low-13 = "8-13"
        14-15 = "14-15"
        16 = "16"
        17-21 = "17-21"
        22-23 = "22-23"
        24-26 = "24-26"
        27-28 = "27-28"
        29-30 = "29-30"
        31-high = "31-";
run;

/* potkil */
proc format;
    value classpotkil
        low-26 = "17-26"
        27-33 = "27-33"
```

```
        34-39 = "34-39"
        40-49 = "40-49"
        50-57 = "50-57"
        58-65 = "58-65"
        66-78 = "66-78"
        79-92 = "79-92"
        93-108 = "93-108"
        109-123 = "109-123"
        124-139 = "124-139"
        140-143 = "140-143"
        144-150 = "144-150"
        151-high = "151-";
run;

/* massa */
proc format;
    value classmassa
        low-691 = "555-691"
        692-720 = "692-720"
        721-800 = "721-800"
        801-905 = "801-905"
        906-980 = "906-980"
        981-1030 = "981-1030"
        1031-1094 = "1031-1094"
        1095-1269 = "1095-1269"
        1270-1379 = "1270-1379"
        1380-1424 = "1380-1424"
        1425-1520 = "1425-1520"
        1521-high = "1521-";
run;

/* Assegno i formati */
data polizze;
    set polizze;

    format prov $classprov.;
    format eta classeta.;
    format potf classpotf.;
    format potkil classpotkil.;
    format massa classmassa.;
run;

proc print data = polizze (obs = 10);
run;
```

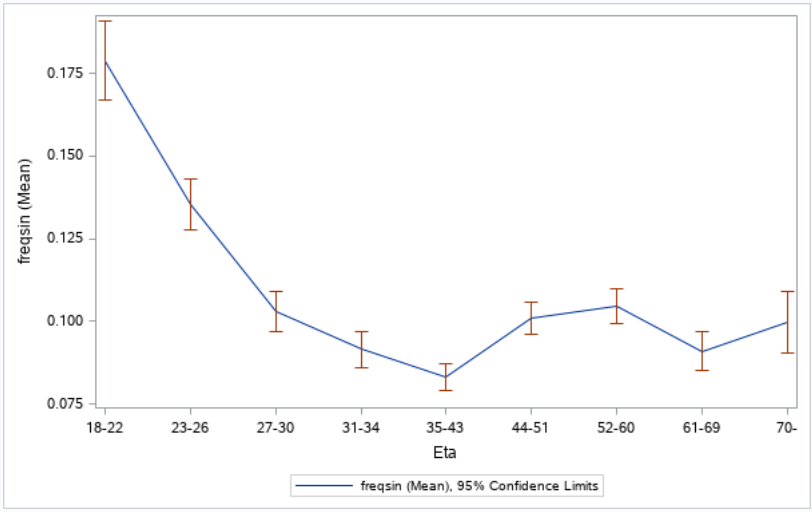
Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin
1	F	35-43	prov8	NO	B	17-26	555-691	8-13	1.00000	0	0.000	0
2	M	35-43	prov5	NO	B	34-39	721-800	8-13	1.00000	0	0.000	0
3	M	44-51	prov7	NO	B	58-65	801-905	14-15	1.00000	0	0.000	0
4	F	18-22	prov10	NO	B	34-39	692-720	8-13	1.00000	0	0.000	0
5	M	44-51	prov9	NO	B	27-33	721-800	8-13	0.20000	0	0.000	0
6	F	44-51	prov8	NO	B	40-49	721-800	14-15	1.00000	0	0.000	0
7	M	35-43	prov1	NO	D	50-57	1031-1094	17-21	1.00000	0	0.000	0
8	M	70-	prov1	SI	B	58-65	906-980	14-15	1.00000	0	0.000	0
9	F	44-51	prov1	NO	B	58-65	801-905	14-15	1.00000	0	0.000	0
10	M	52-60	prov1	NO	B	79-92	1095-1269	17-21	1.00000	1	359.057	1

Frequenza sinistri nei cluster

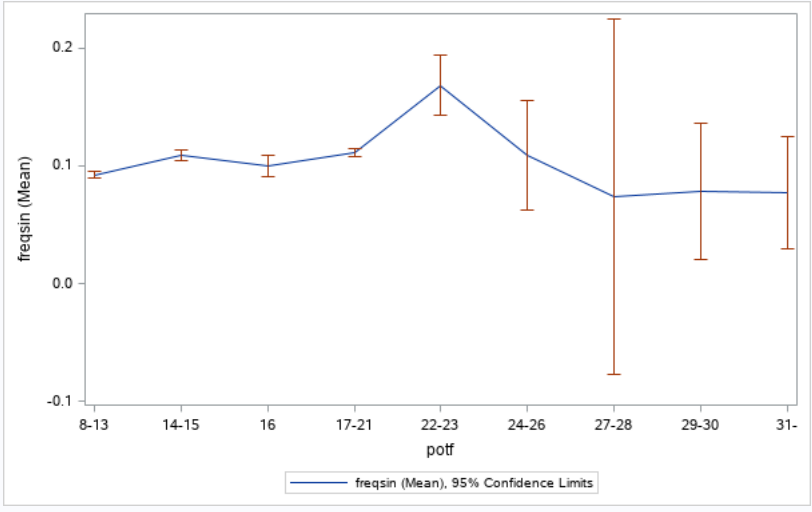
```
/* prov */
proc sgplot data=polizze;
    vline prov / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05;
run;
```




```
/* eta */
proc sgplot data=polizze;
    vline eta / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05;
run;
```

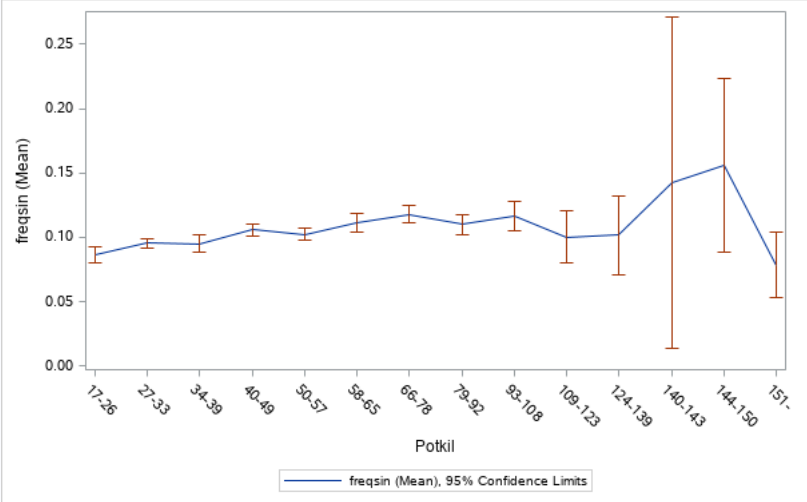



```
/* potf */
proc sgplot data=polizze;
    vline potf / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05;
run;
```

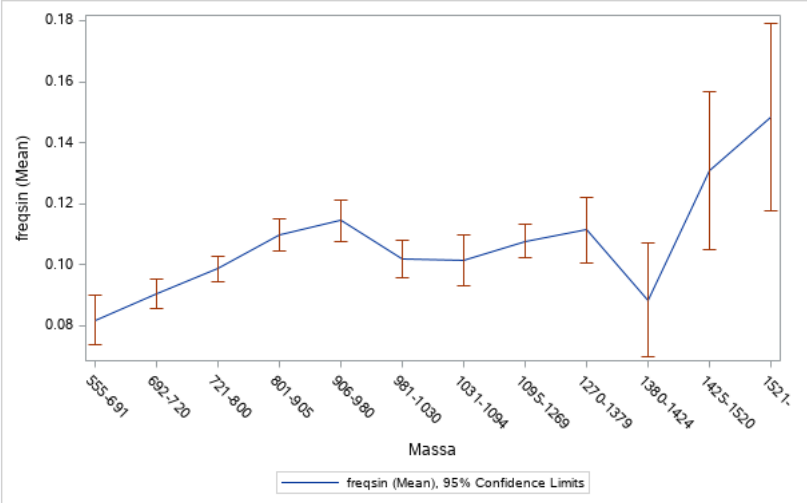



```
/* potkil */
proc sgplot data=polizze;
```

```
    vline potkil / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05;
run;
```




```
/* massa */
proc sgplot data=polizze;
    vline massa / response=freqsin weight=espo stat=mean limitstat=clm alpha = .05;
run;
```



3) Tariffazione con i GLM

3.A.1 Modelli per il numero di sinistri

Preparazione dei dati

```
/* Dataset per modelli con dati individuali */
data polizze;
    set polizze;
    lnespo = log(espo);
    freqsin = nsin / espo;
run;


/* Dataset per modelli con dati raggruppati */
proc means data = polizze nway noprint;
    class sesso capoluogo bendie prov eta potf potkil massa;
    var espo nsin dannotot;
    output out = polizzecum sum = espocum nsincum dannototcum;
run;

data polizzecum;
    set polizzecum;
    lnespocum = log(espocum);
    freqsincum = nsincum / espocum;
run;
```

```
proc print data = polizzecum (obs = 10);
run;
```

Obs	Sesso	Capoluogo	Bendie	Prov	Eta	potf	Potkil	Massa	_TYPE_	_FREQ_	espocum	nsincum	dannototcum	lnespocum	freqs
1	F	NO	B	prov3	18-22	8-13	17-26	555-691	255	3	1.6880	0	0.00	0.52354	0.0
2	F	NO	B	prov3	18-22	8-13	17-26	692-720	255	23	18.9970	1	2019.70	2.94428	0.0
3	F	NO	B	prov3	18-22	8-13	27-33	555-691	255	4	3.3920	0	0.00	1.22142	0.0
4	F	NO	B	prov3	18-22	8-13	27-33	692-720	255	30	23.4110	0	0.00	3.15321	0.0
5	F	NO	B	prov3	18-22	8-13	27-33	721-800	255	64	46.9260	4	3753.05	3.84857	0.0
6	F	NO	B	prov3	18-22	8-13	27-33	906-980	255	1	0.9230	0	0.00	-0.08013	0.0
7	F	NO	B	prov3	18-22	8-13	34-39	692-720	255	7	5.6710	0	0.00	1.73537	0.0
8	F	NO	B	prov3	18-22	8-13	34-39	721-800	255	48	37.7090	3	4314.97	3.62990	0.0
9	F	NO	B	prov3	18-22	8-13	34-39	801-905	255	4	3.6740	0	0.00	1.30128	0.0
10	F	NO	B	prov3	18-22	8-13	40-49	721-800	255	19	14.0980	1	394.96	2.64603	0.0

```
/* Il dataset polizzecum ha 26 249 righe */
proc summary data = polizzecum;
    output out = conta_righe;
run;

proc print data = conta_righe;
run;
```

Obs	_TYPE_	_FREQ_
1	0	26249

3.A.1.1 Modello di Poisson

```
/* Dati individuali, eta */
proc genmod data = polizze;
    class eta(ref='35-43');
    model nsin = eta /
        dist = poisson
        offset = lnespo
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZE
Distribution	Poisson
Link Function	Log
Dependent Variable	nsin
Offset Variable	lnespo

Number of Observations Read	172161
Number of Observations Used	172161

Class Level Information		
Class	Levels	Values
Eta	9	18-22 23-26 27-30 31-34 44-51 52-60 61-69 70- 35-43

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	17E4	66656.7461	0.3872
Scaled Deviance	17E4	66656.7461	0.3872
Pearson Chi-Square	17E4	211077.4956	1.2261
Scaled Pearson X2	17E4	211077.4956	1.2261
Log Likelihood		-44647.2568	
Full Log Likelihood		-45351.7365	
AIC (smaller is better)		90721.4730	
AICC (smaller is better)		90721.4740	
BIC (smaller is better)		90811.9787	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-2.4884	0.0218	-2.5311	-2.4457	13046.5	<.0001
Eta	18-22	1	0.7667	0.0374	0.6934	0.8400	419.96	<.0001
Eta	23-26	1	0.4884	0.0338	0.4222	0.5546	209.15	<.0001
Eta	27-30	1	0.2142	0.0349	0.1458	0.2826	37.63	<.0001
Eta	31-34	1	0.0971	0.0363	0.0261	0.1682	7.17	0.0074
Eta	44-51	1	0.1957	0.0310	0.1350	0.2565	39.86	<.0001
Eta	52-60	1	0.2299	0.0318	0.1676	0.2922	52.34	<.0001
Eta	61-69	1	0.0906	0.0382	0.0158	0.1655	5.64	0.0176
Eta	70-	1	0.1815	0.0487	0.0860	0.2769	13.88	0.0002
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
Eta	8	518.85	<.0001

```
/* Dati raggruppati, eta */
proc genmod data = polizzecum;
    class eta(ref='35-43');
    model nsincum = eta /
        dist = poisson
        offset = lnespocum
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	**Levels**	**Values**
Eta	9	18-22 23-26 27-30 31-34 44-51 52-60 61-69 70- 35-43

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	26E3	20367.2147	0.7762
Scaled Deviance	26E3	20367.2147	0.7762
Pearson Chi-Square	26E3	39689.2852	1.5125
Scaled Pearson X2	26E3	39689.2852	1.5125
Log Likelihood		-11513.4125	
Full Log Likelihood		-18243.0724	
AIC (smaller is better)		36504.1449	
AICC (smaller is better)		36504.1517	
BIC (smaller is better)		36577.7233	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-2.4884	0.0218	-2.5311	-2.4457	13046.5	<.0001
Eta	18-22	1	0.7667	0.0374	0.6934	0.8400	419.96	<.0001
Eta	23-26	1	0.4884	0.0338	0.4222	0.5546	209.15	<.0001
Eta	27-30	1	0.2142	0.0349	0.1458	0.2826	37.63	<.0001
Eta	31-34	1	0.0971	0.0363	0.0261	0.1682	7.17	0.0074
Eta	44-51	1	0.1957	0.0310	0.1350	0.2565	39.86	<.0001
Eta	52-60	1	0.2299	0.0318	0.1676	0.2922	52.34	<.0001
Eta	61-69	1	0.0906	0.0382	0.0158	0.1655	5.64	0.0176
Eta	70-	1	0.1815	0.0487	0.0860	0.2769	13.88	0.0002
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
Eta	8	518.85	<.0001

```
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil(ref='66-78');
    model nsincum = eta potkil /
        dist = poisson
        offset = lnespocum
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	**Levels**	**Values**
Eta	9	18-22 23-26 27-30 31-34 44-51 52-60 61-69 70- 35-43
Potkil	14	109-123 124-139 140-143 144-150 151- 17-26 27-33 34-39 40-49 50-57 58-65 79-92 93-108 66-78

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	20231.0225	0.7714
Scaled Deviance	26E3	20231.0225	0.7714
Pearson Chi-Square	26E3	38161.8840	1.4551
Scaled Pearson X2	26E3	38161.8840	1.4551
Log Likelihood		-11445.3164	
Full Log Likelihood		-18174.9764	
AIC (smaller is better)		36393.9527	
AICC (smaller is better)		36393.9913	
BIC (smaller is better)		36573.8111	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-2.3308	0.0317	-2.3929	-2.2687	5410.09	<.0001
Eta	18-22	1	0.7993	0.0376	0.7256	0.8731	451.02	<.0001
Eta	23-26	1	0.5031	0.0338	0.4368	0.5694	221.04	<.0001
Eta	27-30	1	0.2200	0.0349	0.1515	0.2885	39.66	<.0001
Eta	31-34	1	0.0980	0.0363	0.0269	0.1691	7.30	0.0069
Eta	44-51	1	0.1947	0.0310	0.1339	0.2555	39.42	<.0001
Eta	52-60	1	0.2362	0.0318	0.1739	0.2985	55.16	<.0001
Eta	61-69	1	0.1113	0.0382	0.0363	0.1862	8.47	0.0036
Eta	70-	1	0.2174	0.0488	0.1217	0.3131	19.82	<.0001
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	109-123	1	-0.1738	0.0900	-0.3502	0.0027	3.73	0.0536
Potkil	124-139	1	-0.1594	0.1410	-0.4356	0.1169	1.28	0.2583
Potkil	140-143	1	0.1604	0.4090	-0.6413	0.9621	0.15	0.6949
Potkil	144-150	1	0.2581	0.1709	-0.0769	0.5931	2.28	0.1310
Potkil	151-	1	-0.4037	0.1564	-0.7102	-0.0972	6.67	0.0098
Potkil	17-26	1	-0.3305	0.0423	-0.4133	-0.2477	61.15	<.0001
Potkil	27-33	1	-0.2620	0.0325	-0.3256	-0.1984	65.19	<.0001
Potkil	34-39	1	-0.2846	0.0429	-0.3687	-0.2005	44.00	<.0001
Potkil	40-49	1	-0.1597	0.0328	-0.2240	-0.0954	23.72	<.0001
Potkil	50-57	1	-0.1673	0.0342	-0.2343	-0.1003	23.95	<.0001
Potkil	58-65	1	-0.0596	0.0405	-0.1390	0.0198	2.17	0.1410
Potkil	79-92	1	-0.0810	0.0413	-0.1619	-0.0001	3.85	0.0497
Potkil	93-108	1	-0.0260	0.0503	-0.1245	0.0725	0.27	0.6055
Potkil	66-78	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	8	548.35	<.0001
Potkil	13	136.19	<.0001

```
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil(ref='66-78') massa(ref='906-980');
    model nsincum = eta potkil massa /
        dist = poisson
        offset = lnespocum
        type3;
run;
```

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	9	18-22 23-26 27-30 31-34 44-51 52-60 61-69 70- 35-43
Potkil	14	109-123 124-139 140-143 144-150 151- 17-26 27-33 34-39 40-49 50-57 58-65 79-92 93-108 66-78
Massa	12	1031-1094 1095-1269 1270-1379 1380-1424 1425-1520 1521- 555-691 692-720 721-800 801-905 981-1030 906-980

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	20178.0174	0.7697
Scaled Deviance	26E3	20178.0174	0.7697
Pearson Chi-Square	26E3	37643.0704	1.4359
Scaled Pearson X2	26E3	37643.0704	1.4359
Log Likelihood		-11418.8138	
Full Log Likelihood		-18148.4738	
AIC (smaller is better)		36362.9476	
AICC (smaller is better)		36363.0332	
BIC (smaller is better)		36632.7352	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-2.2876	0.0430	-2.3718	-2.2033	2832.47	<.0001
Eta	18-22	1	0.7991	0.0380	0.7247	0.8735	443.04	<.0001
Eta	23-26	1	0.5046	0.0341	0.4379	0.5714	219.49	<.0001
Eta	27-30	1	0.2227	0.0350	0.1541	0.2913	40.47	<.0001
Eta	31-34	1	0.1010	0.0363	0.0299	0.1722	7.75	0.0054
Eta	44-51	1	0.1930	0.0310	0.1322	0.2538	38.71	<.0001
Eta	52-60	1	0.2356	0.0318	0.1732	0.2980	54.80	<.0001
Eta	61-69	1	0.1111	0.0383	0.0361	0.1861	8.43	0.0037
Eta	70-	1	0.2193	0.0489	0.1235	0.3151	20.13	<.0001
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	109-123	1	-0.2378	0.0925	-0.4192	-0.0565	6.61	0.0102
Potkil	124-139	1	-0.2294	0.1432	-0.5100	0.0512	2.57	0.1091
Potkil	140-143	1	0.0761	0.4097	-0.7269	0.8790	0.03	0.8527
Potkil	144-150	1	0.1513	0.1739	-0.1896	0.4923	0.76	0.3843
Potkil	151-	1	-0.6593	0.1647	-0.9822	-0.3365	16.03	<.0001
Potkil	17-26	1	-0.2049	0.0696	-0.3414	-0.0685	8.67	0.0032
Potkil	27-33	1	-0.1956	0.0540	-0.3016	-0.0897	13.11	0.0003
Potkil	34-39	1	-0.2438	0.0581	-0.3576	-0.1300	17.64	<.0001
Potkil	40-49	1	-0.1569	0.0440	-0.2432	-0.0706	12.70	0.0004
Potkil	50-57	1	-0.1634	0.0382	-0.2383	-0.0885	18.27	<.0001
Potkil	58-65	1	-0.0505	0.0425	-0.1337	0.0328	1.41	0.2346
Potkil	79-92	1	-0.0868	0.0417	-0.1685	-0.0051	4.34	0.0373
Potkil	93-108	1	-0.0473	0.0538	-0.1527	0.0581	0.77	0.3791
Potkil	66-78	0	0.0000	0.0000	0.0000	0.0000	.	.
Massa	1031-1094	1	-0.1086	0.0461	-0.1990	-0.0182	5.55	0.0185
Massa	1095-1269	1	-0.0616	0.0393	-0.1387	0.0155	2.45	0.1175

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Massa	1270-1379	1	0.0015	0.0585	-0.1132	0.1162	0.00	0.9799
Massa	1380-1424	1	-0.2159	0.1130	-0.4373	0.0055	3.65	0.0560
Massa	1425-1520	1	0.2228	0.0840	0.0581	0.3874	7.03	0.0080
Massa	1521-	1	0.4026	0.1073	0.1924	0.6129	14.09	0.0002
Massa	555-691	1	-0.2393	0.0708	-0.3781	-0.1005	11.42	0.0007
Massa	692-720	1	-0.1379	0.0580	-0.2515	-0.0243	5.66	0.0174
Massa	721-800	1	-0.0946	0.0464	-0.1855	-0.0036	4.15	0.0416
Massa	801-905	1	-0.0154	0.0385	-0.0908	0.0599	0.16	0.6878
Massa	981-1030	1	-0.0867	0.0394	-0.1640	-0.0094	4.84	0.0279
Massa	906-980	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	8	537.11	<.0001
Potkil	13	51.08	<.0001
Massa	11	53.01	<.0001

```
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil(ref='66-78') massa(ref='906-980') potf;
    model nsincum = eta potkil massa potf/
        dist = poisson
        offset = lnespocum
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	9	18-22 23-26 27-30 31-34 44-51 52-60 61-69 70- 35-43
Potkil	14	109-123 124-139 140-143 144-150 151- 17-26 27-33 34-39 40-49 50-57 58-65 79-92 93-108 66-78
Massa	12	1031-1094 1095-1269 1270-1379 1380-1424 1425-1520 1521- 555-691 692-720 721-800 801-905 981-1030 906-980
potf	9	14-15 16 17-21 22-23 24-26 27-28 29-30 31- 8-13

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	20079.5225	0.7662
Scaled Deviance	26E3	20079.5225	0.7662
Pearson Chi-Square	26E3	36510.7622	1.3931
Scaled Pearson X2	26E3	36510.7622	1.3931
Log Likelihood		-11369.5664	
Full Log Likelihood		-18099.2263	
AIC (smaller is better)		36280.4526	
AICC (smaller is better)		36280.5841	

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
BIC (smaller is better)		36615.6433	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-2.5882	0.0602	-2.7061	-2.4703	1851.24	<.0001
Eta	18-22	1	0.7942	0.0380	0.7198	0.8686	437.50	<.0001
Eta	23-26	1	0.4959	0.0341	0.4291	0.5627	211.78	<.0001
Eta	27-30	1	0.2150	0.0350	0.1464	0.2836	37.72	<.0001
Eta	31-34	1	0.0979	0.0363	0.0267	0.1690	7.27	0.0070
Eta	44-51	1	0.1919	0.0310	0.1311	0.2527	38.26	<.0001
Eta	52-60	1	0.2371	0.0318	0.1747	0.2995	55.49	<.0001
Eta	61-69	1	0.1149	0.0383	0.0399	0.1899	9.01	0.0027
Eta	70-	1	0.2256	0.0489	0.1298	0.3215	21.30	<.0001
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	109-123	1	-0.1700	0.0934	-0.3531	0.0131	3.31	0.0688
Potkil	124-139	1	-0.1686	0.1518	-0.4662	0.1289	1.23	0.2667
Potkil	140-143	1	0.0173	0.4120	-0.7902	0.8249	0.00	0.9664
Potkil	144-150	1	0.2577	0.1757	-0.0868	0.6021	2.15	0.1426
Potkil	151-	1	-0.4219	0.1931	-0.8004	-0.0434	4.77	0.0289
Potkil	17-26	1	-0.0081	0.0742	-0.1536	0.1374	0.01	0.9132
Potkil	27-33	1	-0.0074	0.0594	-0.1238	0.1089	0.02	0.9003
Potkil	34-39	1	-0.0669	0.0624	-0.1892	0.0554	1.15	0.2835
Potkil	40-49	1	-0.0389	0.0461	-0.1293	0.0514	0.71	0.3982
Potkil	50-57	1	-0.1060	0.0398	-0.1839	-0.0280	7.10	0.0077
Potkil	58-65	1	-0.0148	0.0428	-0.0987	0.0690	0.12	0.7285
Potkil	79-92	1	-0.0985	0.0419	-0.1807	-0.0164	5.53	0.0187
Potkil	93-108	1	-0.0164	0.0543	-0.1229	0.0900	0.09	0.7622
Potkil	66-78	0	0.0000	0.0000	0.0000	0.0000	.	.
Massa	1031-1094	1	-0.2098	0.0487	-0.3053	-0.1142	18.52	<.0001
Massa	1095-1269	1	-0.1972	0.0434	-0.2823	-0.1121	20.62	<.0001
Massa	1270-1379	1	-0.1783	0.0624	-0.3006	-0.0560	8.16	0.0043
Massa	1380-1424	1	-0.3791	0.1146	-0.6038	-0.1544	10.94	0.0009
Massa	1425-1520	1	-0.0592	0.0920	-0.2395	0.1212	0.41	0.5202
Massa	1521-	1	0.0498	0.1262	-0.1976	0.2973	0.16	0.6930
Massa	555-691	1	-0.1430	0.0720	-0.2841	-0.0019	3.94	0.0470
Massa	692-720	1	-0.0287	0.0601	-0.1464	0.0890	0.23	0.6324
Massa	721-800	1	0.0150	0.0492	-0.0814	0.1113	0.09	0.7605
Massa	801-905	1	0.0366	0.0394	-0.0406	0.1138	0.86	0.3531
Massa	981-1030	1	-0.1363	0.0403	-0.2153	-0.0573	11.43	0.0007
Massa	906-980	0	0.0000	0.0000	0.0000	0.0000	.	.
potf	14-15	1	0.2045	0.0378	0.1305	0.2786	29.34	<.0001
potf	16	1	0.1562	0.0560	0.0464	0.2660	7.77	0.0053
potf	17-21	1	0.4110	0.0514	0.3103	0.5117	64.01	<.0001
potf	22-23	1	0.7827	0.0882	0.6098	0.9555	78.77	<.0001
potf	24-26	1	0.4922	0.2383	0.0252	0.9592	4.27	0.0389
potf	27-28	1	0.0035	0.6017	-1.1758	1.1829	0.00	0.9953
potf	29-30	1	0.2932	0.3754	-0.4426	1.0289	0.61	0.4349
potf	31-	1	0.1805	0.4017	-0.6070	0.9679	0.20	0.6533
potf	8-13	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	8	526.37	<.0001
Potkil	13	25.04	0.0228
Massa	11	51.68	<.0001
potf	8	98.49	<.0001

```
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil(ref='66-78') massa(ref='906-980') bendie;
    model nsincum = eta potkil massa bendie /
        dist = poisson
        offset = lnespocum
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	9	18-22 23-26 27-30 31-34 44-51 52-60 61-69 70- 35-43
Potkil	14	109-123 124-139 140-143 144-150 151- 17-26 27-33 34-39 40-49 50-57 58-65 79-92 93-108 66-78
Massa	12	1031-1094 1095-1269 1270-1379 1380-1424 1425-1520 1521- 555-691 692-720 721-800 801-905 981-1030 906-980
Bendie	2	B D

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	19964.4087	0.7616
Scaled Deviance	26E3	19964.4087	0.7616
Pearson Chi-Square	26E3	35130.4937	1.3401
Scaled Pearson X2	26E3	35130.4937	1.3401
Log Likelihood		-11312.0095	
Full Log Likelihood		-18041.6694	
AIC (smaller is better)		36151.3389	
AICC (smaller is better)		36151.4296	
BIC (smaller is better)		36429.3019	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.8284	0.0522	-1.9308	-1.7260	1224.67	<.0001
Eta	18-22	1	0.7887	0.0380	0.7143	0.8631	431.53	<.0001
Eta	23-26	1	0.4885	0.0341	0.4217	0.5553	205.50	<.0001
Eta	27-30	1	0.2112	0.0350	0.1426	0.2798	36.38	<.0001
Eta	31-34	1	0.0929	0.0363	0.0217	0.1640	6.55	0.0105
Eta	44-51	1	0.1911	0.0310	0.1303	0.2519	37.97	<.0001
Eta	52-60	1	0.2374	0.0318	0.1750	0.2997	55.64	<.0001
Eta	61-69	1	0.1144	0.0383	0.0394	0.1894	8.94	0.0028
Eta	70-	1	0.2273	0.0489	0.1316	0.3231	21.64	<.0001

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	109-123	1	-0.0330	0.0931	-0.2155	0.1494	0.13	0.7227
Potkil	124-139	1	-0.0001	0.1437	-0.2817	0.2816	0.00	0.9997
Potkil	140-143	1	0.2989	0.4098	-0.5043	1.1021	0.53	0.4658
Potkil	144-150	1	0.3904	0.1741	0.0491	0.7317	5.02	0.0250
Potkil	151-	1	-0.3129	0.1654	-0.6370	0.0112	3.58	0.0585
Potkil	17-26	1	-0.3231	0.0697	-0.4596	-0.1866	21.51	<.0001
Potkil	27-33	1	-0.3169	0.0541	-0.4231	-0.2108	34.26	<.0001
Potkil	34-39	1	-0.3685	0.0582	-0.4825	-0.2545	40.15	<.0001
Potkil	40-49	1	-0.2533	0.0441	-0.3397	-0.1670	33.06	<.0001
Potkil	50-57	1	-0.2147	0.0385	-0.2900	-0.1393	31.14	<.0001
Potkil	58-65	1	-0.0600	0.0425	-0.1433	0.0233	1.99	0.1578
Potkil	79-92	1	-0.0013	0.0421	-0.0839	0.0812	0.00	0.9749
Potkil	93-108	1	0.1026	0.0542	-0.0036	0.2089	3.58	0.0584
Potkil	66-78	0	0.0000	0.0000	0.0000	0.0000	.	.
Massa	1031-1094	1	-0.1483	0.0461	-0.2387	-0.0580	10.35	0.0013
Massa	1095-1269	1	-0.1403	0.0398	-0.2182	-0.0624	12.45	0.0004
Massa	1270-1379	1	-0.1867	0.0596	-0.3034	-0.0699	9.82	0.0017
Massa	1380-1424	1	-0.3746	0.1130	-0.5960	-0.1532	10.99	0.0009
Massa	1425-1520	1	-0.0823	0.0858	-0.2504	0.0859	0.92	0.3376
Massa	1521-	1	0.0122	0.1096	-0.2025	0.2270	0.01	0.9110
Massa	555-691	1	-0.0757	0.0716	-0.2161	0.0646	1.12	0.2904
Massa	692-720	1	0.0265	0.0589	-0.0890	0.1420	0.20	0.6534
Massa	721-800	1	0.0621	0.0475	-0.0310	0.1552	1.71	0.1910
Massa	801-905	1	0.0875	0.0390	0.0112	0.1639	5.04	0.0247
Massa	981-1030	1	-0.0437	0.0395	-0.1212	0.0337	1.23	0.2683
Massa	906-980	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	-0.5015	0.0330	-0.5661	-0.4369	231.24	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	8	518.15	<.0001
Potkil	13	78.41	<.0001
Massa	11	48.61	<.0001
Bendie	1	213.61	<.0001

```
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil(ref='66-78') massa(ref='906-980') bendie sesso;
    model nsincum = eta potkil massa bendie sesso /
        dist = poisson
        offset = lnespocum
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	9	18-22 23-26 27-30 31-34 44-51 52-60 61-69 70- 35-43
Potkil	14	109-123 124-139 140-143 144-150 151- 17-26 27-33 34-39 40-49 50-57 58-65 79-92 93-108 66-78
Massa	12	1031-1094 1095-1269 1270-1379 1380-1424 1425-1520 1521- 555-691 692-720 721-800 801-905 981-1030 906-980
Bendie	2	B D
Sesso	2	F M

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	19964.3907	0.7616
Scaled Deviance	26E3	19964.3907	0.7616
Pearson Chi-Square	26E3	35140.5681	1.3405
Scaled Pearson X2	26E3	35140.5681	1.3405
Log Likelihood		-11312.0005	
Full Log Likelihood		-18041.6604	
AIC (smaller is better)		36153.3209	
AICC (smaller is better)		36153.4170	
BIC (smaller is better)		36439.4593	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.8281	0.0523	-1.9306	-1.7256	1221.91	<.0001
Eta	18-22	1	0.7886	0.0380	0.7141	0.8630	431.18	<.0001
Eta	23-26	1	0.4885	0.0341	0.4217	0.5552	205.48	<.0001
Eta	27-30	1	0.2112	0.0350	0.1426	0.2798	36.39	<.0001
Eta	31-34	1	0.0929	0.0363	0.0218	0.1640	6.55	0.0105
Eta	44-51	1	0.1910	0.0310	0.1302	0.2518	37.90	<.0001
Eta	52-60	1	0.2370	0.0319	0.1745	0.2996	55.18	<.0001
Eta	61-69	1	0.1138	0.0385	0.0384	0.1893	8.75	0.0031
Eta	70-	1	0.2266	0.0492	0.1302	0.3230	21.21	<.0001
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	109-123	1	-0.0332	0.0931	-0.2156	0.1493	0.13	0.7215
Potkil	124-139	1	-0.0002	0.1437	-0.2818	0.2815	0.00	0.9990
Potkil	140-143	1	0.2987	0.4098	-0.5045	1.1019	0.53	0.4661
Potkil	144-150	1	0.3901	0.1742	0.0488	0.7315	5.02	0.0251
Potkil	151-	1	-0.3132	0.1654	-0.6373	0.0110	3.59	0.0583
Potkil	17-26	1	-0.3223	0.0699	-0.4593	-0.1852	21.25	<.0001
Potkil	27-33	1	-0.3164	0.0543	-0.4228	-0.2099	33.93	<.0001
Potkil	34-39	1	-0.3679	0.0583	-0.4822	-0.2536	39.80	<.0001
Potkil	40-49	1	-0.2529	0.0441	-0.3394	-0.1664	32.84	<.0001
Potkil	50-57	1	-0.2145	0.0385	-0.2899	-0.1391	31.08	<.0001
Potkil	58-65	1	-0.0600	0.0425	-0.1433	0.0233	1.99	0.1578
Potkil	79-92	1	-0.0014	0.0421	-0.0840	0.0812	0.00	0.9733
Potkil	93-108	1	0.1024	0.0542	-0.0038	0.2087	3.57	0.0589
Potkil	66-78	0	0.0000	0.0000	0.0000	0.0000	.	.
Massa	1031-1094	1	-0.1484	0.0461	-0.2387	-0.0580	10.35	0.0013
Massa	1095-1269	1	-0.1403	0.0398	-0.2182	-0.0624	12.45	0.0004
Massa	1270-1379	1	-0.1866	0.0596	-0.3034	-0.0698	9.81	0.0017
Massa	1380-1424	1	-0.3745	0.1130	-0.5959	-0.1530	10.99	0.0009
Massa	1425-1520	1	-0.0821	0.0858	-0.2502	0.0861	0.91	0.3389
Massa	1521-	1	0.0127	0.1096	-0.2022	0.2275	0.01	0.9081

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Massa	555-691	1	-0.0751	0.0718	-0.2158	0.0656	1.09	0.2956
Massa	692-720	1	0.0269	0.0590	-0.0888	0.1425	0.21	0.6489
Massa	721-800	1	0.0625	0.0476	-0.0308	0.1558	1.73	0.1889
Massa	801-905	1	0.0877	0.0390	0.0113	0.1641	5.06	0.0245
Massa	981-1030	1	-0.0438	0.0395	-0.1213	0.0336	1.23	0.2676
Massa	906-980	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	-0.5012	0.0330	-0.5660	-0.4365	230.12	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Sesso	F	1	-0.0028	0.0210	-0.0441	0.0384	0.02	0.8933
Sesso	M	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	8	518.13	<.0001
Potkil	13	77.83	<.0001
Massa	11	48.62	<.0001
Bendie	1	212.73	<.0001
Sesso	1	0.02	0.8933

```
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil(ref='66-78') massa(ref='906-980') bendie capoluogo;
    model nsincum = eta potkil massa bendie capoluogo /
        dist = poisson
        offset = lnespocum
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	9	18-22 23-26 27-30 31-34 44-51 52-60 61-69 70- 35-43
Potkil	14	109-123 124-139 140-143 144-150 151- 17-26 27-33 34-39 40-49 50-57 58-65 79-92 93-108 66-78
Massa	12	1031-1094 1095-1269 1270-1379 1380-1424 1425-1520 1521- 555-691 692-720 721-800 801-905 981-1030 906-980
Bendie	2	B D
Capoluogo	2	NO SI

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	19721.4813	0.7523
Scaled Deviance	26E3	19721.4813	0.7523
Pearson Chi-Square	26E3	32393.3269	1.2357
Scaled Pearson X2	26E3	32393.3269	1.2357
Log Likelihood		-11190.5458	

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Full Log Likelihood		-17920.2058	
AIC (smaller is better)		35910.4115	
AICC (smaller is better)		35910.5076	
BIC (smaller is better)		36196.5499	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.5455	0.0550	-1.6533	-1.4378	790.46	<.0001
Eta	18-22	1	0.8086	0.0380	0.7342	0.8831	453.17	<.0001
Eta	23-26	1	0.4985	0.0341	0.4317	0.5653	213.96	<.0001
Eta	27-30	1	0.2148	0.0350	0.1462	0.2834	37.64	<.0001
Eta	31-34	1	0.0922	0.0363	0.0211	0.1634	6.46	0.0110
Eta	44-51	1	0.1864	0.0310	0.1256	0.2472	36.10	<.0001
Eta	52-60	1	0.2254	0.0318	0.1630	0.2878	50.14	<.0001
Eta	61-69	1	0.0937	0.0383	0.0186	0.1687	5.98	0.0144
Eta	70-	1	0.1927	0.0489	0.0968	0.2886	15.52	<.0001
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	109-123	1	-0.0351	0.0931	-0.2175	0.1474	0.14	0.7063
Potkil	124-139	1	-0.0161	0.1437	-0.2978	0.2656	0.01	0.9108
Potkil	140-143	1	0.3003	0.4098	-0.5029	1.1035	0.54	0.4637
Potkil	144-150	1	0.4041	0.1742	0.0627	0.7455	5.38	0.0203
Potkil	151-	1	-0.3249	0.1654	-0.6492	-0.0007	3.86	0.0495
Potkil	17-26	1	-0.2975	0.0697	-0.4341	-0.1610	18.25	<.0001
Potkil	27-33	1	-0.3007	0.0541	-0.4068	-0.1946	30.84	<.0001
Potkil	34-39	1	-0.3507	0.0582	-0.4647	-0.2367	36.34	<.0001
Potkil	40-49	1	-0.2385	0.0440	-0.3248	-0.1522	29.32	<.0001
Potkil	50-57	1	-0.2035	0.0385	-0.2788	-0.1281	27.99	<.0001
Potkil	58-65	1	-0.0572	0.0425	-0.1404	0.0261	1.81	0.1784
Potkil	79-92	1	-0.0036	0.0421	-0.0861	0.0790	0.01	0.9327
Potkil	93-108	1	0.1003	0.0542	-0.0059	0.2066	3.42	0.0643
Potkil	66-78	0	0.0000	0.0000	0.0000	0.0000	.	.
Massa	1031-1094	1	-0.1421	0.0461	-0.2325	-0.0517	9.49	0.0021
Massa	1095-1269	1	-0.1375	0.0398	-0.2155	-0.0596	11.96	0.0005
Massa	1270-1379	1	-0.1863	0.0596	-0.3031	-0.0695	9.78	0.0018
Massa	1380-1424	1	-0.3823	0.1130	-0.6037	-0.1608	11.45	0.0007
Massa	1425-1520	1	-0.0955	0.0858	-0.2638	0.0727	1.24	0.2659
Massa	1521-	1	0.0133	0.1096	-0.2016	0.2281	0.01	0.9036
Massa	555-691	1	-0.0942	0.0716	-0.2345	0.0461	1.73	0.1881
Massa	692-720	1	0.0211	0.0589	-0.0943	0.1366	0.13	0.7198
Massa	721-800	1	0.0604	0.0475	-0.0326	0.1535	1.62	0.2030
Massa	801-905	1	0.0851	0.0390	0.0088	0.1615	4.78	0.0289
Massa	981-1030	1	-0.0424	0.0395	-0.1198	0.0350	1.15	0.2832
Massa	906-980	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	-0.5194	0.0330	-0.5841	-0.4547	247.75	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	-0.3422	0.0213	-0.3839	-0.3005	258.58	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	8	548.11	<.0001

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Potkil	13	72.46	<.0001
Massa	11	48.64	<.0001
Bendie	1	228.22	<.0001
Capoluogo	1	242.93	<.0001

```
/* Accorpamento classi */

/* eta */
/* Accetti H0 - > Sì accorpamenti */
ods select contrasts;
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil(ref='66-78') massa(ref='906-980') bendie capoluogo prov(ref='prov1');
    model nsincum = eta potkil massa bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        type3;
    contrast "eta 61-" eta 0  0  0  0  0  0  1 -1  0;
run;
```

The GENMOD Procedure

Contrast Results				
Contrast	DF	Chi-Square	Pr > ChiSq	Type
eta 61-	1	3.67	0.0554	LR

```
/* potkil */
/* Accetto H0 -> Sì accorpamenti */
ods select contrasts;
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil(ref='66-78') massa(ref='906-980') bendie capoluogo prov(ref='prov1');
    model nsincum = eta potkil massa bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        type3;
    contrast "potkil" potkil 1 -1  0  0  0  0  0  0  0  0  0  0  0,
                      potkil 0  1 -1  0  0  0  0  0  0  0  0  0  0,
                      potkil 0  0  1 -1  0  0  0  0  0  0  0  0  0,
                      potkil 0  0  0  1 -1  0  0  0  0  0  0  0  0;
run;
```

The GENMOD Procedure

Contrast Results				
Contrast	DF	Chi-Square	Pr > ChiSq	Type
potkil	4	10.38	0.0345	LR

```
/* massa */
/* Accetto H0 -> Sì accorpamenti */
ods select contrasts;
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil(ref='66-78') massa(ref='906-980') bendie capoluogo prov(ref='prov1');
    model nsincum = eta potkil massa bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        type3;
    contrast "massa" massa  0  0  0  0  0  0  1 -1  0  0  0  0,
                     massa  0  0  0  0  0  0  0  1 -1  0  0  0,
                     massa  0  0  0  0  0  0  0  0  1 -1  0  0,
                     massa  0  0  0  0  0  0  0  0  0  1 -1;
run;
```

The GENMOD Procedure

Contrast Results				
Contrast	DF	Chi-Square	Pr > ChiSq	Type
massa	4	10.34	0.0350	LR

```
/* Faccio gli accorpamenti */

/* eta */
proc format;
    value classeta
        low-22 = "18-22"
        23-26 = "23-26"
        27-30 = "27-30"
        31-34 = "31-34"
        35-43 = "35-43"
        44-51 = "44-51"
        52-60 = "52-60"
        61-high = "61-";
run;

/* potkil */
proc format;
    value classpotkil
        low-57 = "-57"
        58-high = "58-";
run;

/* massa */
proc format;
    value classmassa
        low-1030 = "-1030"
        1031-1379 = "1031-1379"
        1380-1424 = "1380-1424"
        1425-high = "1425-";
run;

/* Il format si aggiorna in automatico nel dataset */
proc print data = polizze (obs = 10);
run;
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin	lnespo
1	F	35-43	prov8	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
2	M	35-43	prov5	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
3	M	44-51	prov7	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
4	F	18-22	prov10	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
5	M	44-51	prov9	NO	B	-57	-1030	8-13	0.20000	0	0.000	0	-1.60944
6	F	44-51	prov8	NO	B	-57	-1030	14-15	1.00000	0	0.000	0	0.00000
7	M	35-43	prov1	NO	D	-57	1031-1379	17-21	1.00000	0	0.000	0	0.00000
8	M	61-	prov1	SI	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
9	F	44-51	prov1	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
10	M	52-60	prov1	NO	B	58-	1031-1379	17-21	1.00000	1	359.057	1	0.00000

```
/* modello con livelli accorpati */
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil massa bendie capoluogo prov(ref='prov1');
    model nsincum = eta potkil massa bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log

Model Information	
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	8	18-22 23-26 27-30 31-34 44-51 52-60 61- 35-43
Potkil	2	-57 58-
Massa	4	-1030 1031-1379 1380-1424 1425-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	12	prov10 prov11 prov12 prov2 prov3 prov4 prov5 prov6 prov7 prov8 prov9 prov1

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	19374.9753	0.7388
Scaled Deviance	26E3	19374.9753	0.7388
Pearson Chi-Square	26E3	31273.9757	1.1926
Scaled Pearson X2	26E3	31273.9757	1.1926
Log Likelihood		-11017.2928	
Full Log Likelihood		-17746.9527	
AIC (smaller is better)		35543.9055	
AICC (smaller is better)		35543.9550	
BIC (smaller is better)		35748.2900	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.7699	0.0677	-1.9027	-1.6372	682.67	<.0001
Eta	18-22	1	0.8400	0.0378	0.7660	0.9140	494.78	<.0001
Eta	23-26	1	0.5168	0.0339	0.4503	0.5833	232.00	<.0001
Eta	27-30	1	0.2237	0.0350	0.1551	0.2922	40.92	<.0001
Eta	31-34	1	0.0960	0.0363	0.0249	0.1672	7.01	0.0081
Eta	44-51	1	0.1825	0.0310	0.1217	0.2433	34.64	<.0001
Eta	52-60	1	0.2150	0.0318	0.1526	0.2774	45.67	<.0001
Eta	61-	1	0.1164	0.0336	0.0505	0.1824	11.98	0.0005
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.2159	0.0259	-0.2666	-0.1652	69.74	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Massa	-1030	1	0.0076	0.0647	-0.1192	0.1345	0.01	0.9062
Massa	1031-1379	1	-0.0946	0.0612	-0.2146	0.0253	2.39	0.1221
Massa	1380-1424	1	-0.2787	0.1190	-0.5120	-0.0455	5.49	0.0192
Massa	1425-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	-0.4852	0.0303	-0.5446	-0.4258	256.22	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	-0.2836	0.0216	-0.3260	-0.2411	171.59	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10	1	-0.2317	0.0485	-0.3268	-0.1366	22.82	<.0001
Prov	prov11	1	0.5183	0.0475	0.4252	0.6114	119.09	<.0001
Prov	prov12	1	-0.4993	0.1147	-0.7242	-0.2745	18.95	<.0001
Prov	prov2	1	0.3631	0.0630	0.2397	0.4865	33.24	<.0001
Prov	prov3	1	0.0533	0.0364	-0.0179	0.1246	2.15	0.1424
Prov	prov4	1	-0.0786	0.0338	-0.1448	-0.0125	5.43	0.0198
Prov	prov5	1	0.1152	0.0335	0.0495	0.1809	11.81	0.0006

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Prov	prov6	1	0.2006	0.0350	0.1319	0.2692	32.78	<.0001
Prov	prov7	1	0.2210	0.0428	0.1371	0.3049	26.66	<.0001
Prov	prov8	1	0.2775	0.0313	0.2161	0.3389	78.46	<.0001
Prov	prov9	1	0.3905	0.0484	0.2957	0.4854	65.18	<.0001
Prov	prov1	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	7	598.63	<.0001
Potkil	1	67.96	<.0001
Massa	3	18.65	0.0003
Bendie	1	231.49	<.0001
Capoluogo	1	163.48	<.0001
Prov	11	403.20	<.0001

```
/* rimuovo massa */
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil bendie capoluogo prov(ref='prov1');
    model nsincum = eta potkil bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	8	18-22 23-26 27-30 31-34 44-51 52-60 61- 35-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	12	prov10 prov11 prov12 prov2 prov3 prov4 prov5 prov6 prov7 prov8 prov9 prov1

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	19393.6287	0.7395
Scaled Deviance	26E3	19393.6287	0.7395
Pearson Chi-Square	26E3	31381.2516	1.1965
Scaled Pearson X2	26E3	31381.2516	1.1965
Log Likelihood		-11026.6195	
Full Log Likelihood		-17756.2794	
AIC (smaller is better)		35556.5588	
AICC (smaller is better)		35556.5974	

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
BIC (smaller is better)		35736.4173	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.8533	0.0439	-1.9394	-1.7672	1780.63	<.0001
Eta	18-22	1	0.8516	0.0376	0.7778	0.9253	512.06	<.0001
Eta	23-26	1	0.5255	0.0338	0.4592	0.5918	241.26	<.0001
Eta	27-30	1	0.2280	0.0349	0.1596	0.2965	42.61	<.0001
Eta	31-34	1	0.0976	0.0363	0.0265	0.1687	7.24	0.0071
Eta	44-51	1	0.1832	0.0310	0.1225	0.2440	34.93	<.0001
Eta	52-60	1	0.2165	0.0318	0.1541	0.2788	46.32	<.0001
Eta	61-	1	0.1192	0.0336	0.0532	0.1851	12.55	0.0004
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.1544	0.0190	-0.1917	-0.1171	65.89	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	-0.4639	0.0288	-0.5204	-0.4074	258.83	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	-0.2837	0.0216	-0.3261	-0.2413	171.79	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10	1	-0.2306	0.0485	-0.3256	-0.1355	22.59	<.0001
Prov	prov11	1	0.5229	0.0475	0.4298	0.6159	121.32	<.0001
Prov	prov12	1	-0.4986	0.1147	-0.7234	-0.2737	18.89	<.0001
Prov	prov2	1	0.3638	0.0630	0.2403	0.4872	33.37	<.0001
Prov	prov3	1	0.0527	0.0364	-0.0186	0.1240	2.10	0.1473
Prov	prov4	1	-0.0784	0.0338	-0.1445	-0.0122	5.39	0.0202
Prov	prov5	1	0.1160	0.0335	0.0503	0.1817	11.97	0.0005
Prov	prov6	1	0.2018	0.0350	0.1332	0.2705	33.20	<.0001
Prov	prov7	1	0.2228	0.0428	0.1390	0.3067	27.11	<.0001
Prov	prov8	1	0.2798	0.0313	0.2184	0.3412	79.82	<.0001
Prov	prov9	1	0.3915	0.0484	0.2967	0.4863	65.50	<.0001
Prov	prov1	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	7	620.66	<.0001
Potkil	1	64.81	<.0001
Bendie	1	230.93	<.0001
Capoluogo	1	163.67	<.0001
Prov	11	407.01	<.0001

```
/* Province */
/* Accetto H0 -> Accorpo i livelli */
ods select contrasts;
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil massa bendie capoluogo prov(ref='prov1');
    model nsincum = eta potkil massa bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        type3;
    contrast "province" prov 1  0 -1  0  0  0  0  0  0  0  0, /* prov10-prov12 */
                        prov 0  0  0  1  0  0  0  0  0  0 -1  0, /* prov2-prov9 */
                        prov 0  0  0  0  1  0  0  0  0  0  0 -1; /* prov1-prov3 */
run;
```

The GENMOD Procedure

Contrast Results				
Contrast	DF	Chi-Square	Pr > ChiSq	Type
province	3	7.56	0.0561	LR

```
/* Accorpo le province */
/* prov */
proc format;
    value $classprov

"RC","VT","CN","OR","RA","VC","FE","LC","SS","VV","BZ","PV","RG","CH","PG","AR","TE","TN","VR","EN","NO","SV","VI","MC","MT","RE
","BS","RI","AG","AV","PC" = "prov1-3"
        "BN","PO","IM","BA","PT","TA","SP","CA","ROMA","PA" = "prov2-9"
        "AL","SO","GO","LT","PR","PN","GR","UD","TV","PD" = "prov4"
        "SI","TR","AP","LO","FG","ME","LU","CZ","FR","CT","VE","BG","IS","MO","TP" = "prov5"
        "CL","PI","VA","BR","FO","LI","SR","CO","SA" = "prov6"
        "LE","RN","AN","MS","BO","GE","TS" = "prov7"
        "CB","FI","NU","PE","TO","MI" = "prov8"
        "BL","PZ","BI","CR","CS","AT","MN","PS","AQ","RSM","VB","RO" = "prov10-12"
        "AO","NA","CE","KR" = "prov11";
run;

proc print data = polizze (obs = 10);
run;
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin	lnespo
1	F	35-43	prov8	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
2	M	35-43	prov5	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
3	M	44-51	prov7	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
4	F	18-22	prov10-12	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
5	M	44-51	prov2-9	NO	B	-57	-1030	8-13	0.20000	0	0.000	0	-1.60944
6	F	44-51	prov8	NO	B	-57	-1030	14-15	1.00000	0	0.000	0	0.00000
7	M	35-43	prov1-3	NO	D	-57	1031-1379	17-21	1.00000	0	0.000	0	0.00000
8	M	61-	prov1-3	SI	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
9	F	44-51	prov1-3	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
10	M	52-60	prov1-3	NO	B	58-	1031-1379	17-21	1.00000	1	359.057	1	0.00000

```
/* Modello di Poisson definitivo */
proc genmod data = polizzecum plots = stdreschi;
    class eta(ref='35-43') potkil bendie capoluogo prov(ref='prov1-3');
    model nsincum = eta potkil bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	8	18-22 23-26 27-30 31-34 44-51 52-60 61- 35-43

Class Level Information		
Class	**Levels**	**Values**
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	9	prov10-12 prov11 prov2-9 prov4 prov5 prov6 prov7 prov8 prov1-3

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Deviance	26E3	19401.1531	0.7397
Scaled Deviance	26E3	19401.1531	0.7397
Pearson Chi-Square	26E3	31341.9422	1.1949
Scaled Pearson X2	26E3	31341.9422	1.1949
Log Likelihood		-11030.3817	
Full Log Likelihood		-17760.0417	
AIC (smaller is better)		35558.0833	
AICC (smaller is better)		35558.1123	
BIC (smaller is better)		35713.4156	

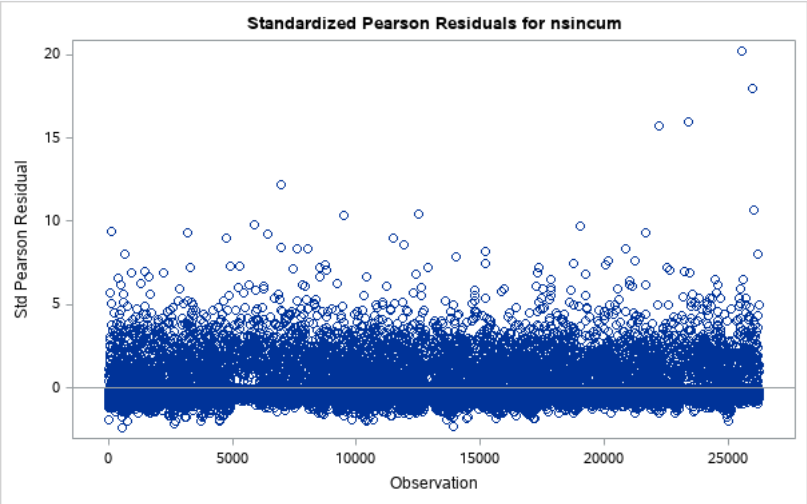
Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-1.8338	0.0417	-1.9156	-1.7520	1930.62	<.0001
Eta	18-22	1	0.8517	0.0376	0.7780	0.9255	512.26	<.0001
Eta	23-26	1	0.5256	0.0338	0.4593	0.5919	241.34	<.0001
Eta	27-30	1	0.2280	0.0349	0.1595	0.2964	42.58	<.0001
Eta	31-34	1	0.0974	0.0363	0.0263	0.1685	7.22	0.0072
Eta	44-51	1	0.1833	0.0310	0.1225	0.2440	34.94	<.0001
Eta	52-60	1	0.2171	0.0318	0.1547	0.2794	46.57	<.0001
Eta	61-	1	0.1193	0.0336	0.0533	0.1852	12.57	0.0004
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.1546	0.0190	-0.1919	-0.1173	66.05	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	-0.4636	0.0288	-0.5201	-0.4071	258.53	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	-0.2839	0.0216	-0.3263	-0.2416	172.74	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10-12	1	-0.2886	0.0439	-0.3747	-0.2025	43.21	<.0001
Prov	prov11	1	0.5033	0.0455	0.4142	0.5924	122.63	<.0001
Prov	prov2-9	1	0.3623	0.0389	0.2860	0.4385	86.64	<.0001
Prov	prov4	1	-0.0980	0.0308	-0.1584	-0.0375	10.09	0.0015
Prov	prov5	1	0.0964	0.0306	0.0365	0.1563	9.94	0.0016
Prov	prov6	1	0.1822	0.0322	0.1191	0.2454	31.99	<.0001
Prov	prov7	1	0.2032	0.0405	0.1238	0.2827	25.13	<.0001
Prov	prov8	1	0.2602	0.0281	0.2050	0.3154	85.46	<.0001
Prov	prov1-3	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
Eta	7	620.90	<.0001
Potkil	1	64.97	<.0001
Bendie	1	230.67	<.0001
Capoluogo	1	164.52	<.0001
Prov	8	399.48	<.0001

The GENMOD Procedure




```
/* Modello di Poisson definitivo */
proc genmod data = polizzecum plots = stdreschi(xbeta);
    class eta(ref='35-43') potkil bendie capoluogo prov(ref='prov1-3');
    model nsincum = eta potkil bendie capoluogo prov /
        dist = poisson
        offset = lnespocum;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	8	18-22 23-26 27-30 31-34 44-51 52-60 61- 35-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	9	prov10-12 prov11 prov2-9 prov4 prov5 prov6 prov7 prov8 prov1-3

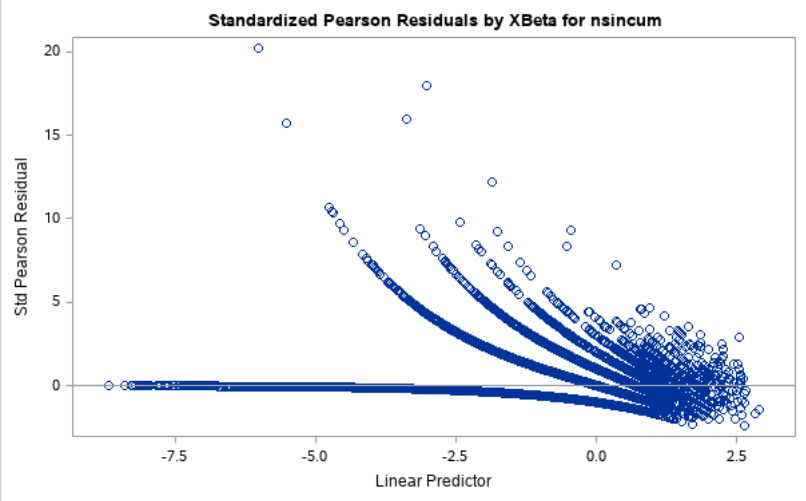
Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	19401.1531	0.7397
Scaled Deviance	26E3	19401.1531	0.7397
Pearson Chi-Square	26E3	31341.9422	1.1949
Scaled Pearson X2	26E3	31341.9422	1.1949
Log Likelihood		-11030.3817	
Full Log Likelihood		-17760.0417	
AIC (smaller is better)		35558.0833	
AICC (smaller is better)		35558.1123	
BIC (smaller is better)		35713.4156	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.8338	0.0417	-1.9156	-1.7520	1930.62	<.0001
Eta	18-22	1	0.8517	0.0376	0.7780	0.9255	512.26	<.0001
Eta	23-26	1	0.5256	0.0338	0.4593	0.5919	241.34	<.0001
Eta	27-30	1	0.2280	0.0349	0.1595	0.2964	42.58	<.0001
Eta	31-34	1	0.0974	0.0363	0.0263	0.1685	7.22	0.0072
Eta	44-51	1	0.1833	0.0310	0.1225	0.2440	34.94	<.0001
Eta	52-60	1	0.2171	0.0318	0.1547	0.2794	46.57	<.0001
Eta	61-	1	0.1193	0.0336	0.0533	0.1852	12.57	0.0004
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.1546	0.0190	-0.1919	-0.1173	66.05	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	-0.4636	0.0288	-0.5201	-0.4071	258.53	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	-0.2839	0.0216	-0.3263	-0.2416	172.74	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10-12	1	-0.2886	0.0439	-0.3747	-0.2025	43.21	<.0001
Prov	prov11	1	0.5033	0.0455	0.4142	0.5924	122.63	<.0001
Prov	prov2-9	1	0.3623	0.0389	0.2860	0.4385	86.64	<.0001
Prov	prov4	1	-0.0980	0.0308	-0.1584	-0.0375	10.09	0.0015
Prov	prov5	1	0.0964	0.0306	0.0365	0.1563	9.94	0.0016
Prov	prov6	1	0.1822	0.0322	0.1191	0.2454	31.99	<.0001
Prov	prov7	1	0.2032	0.0405	0.1238	0.2827	25.13	<.0001
Prov	prov8	1	0.2602	0.0281	0.2050	0.3154	85.46	<.0001
Prov	prov1-3	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

The GENMOD Procedure



3.A.1.2 Modello di Poisson con sovradispersione

```
/* Modello con dati raggruppati */
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil bendie capoluogo prov(ref='prov1-3');
    model nsincum = eta potkil bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        scale = pearson
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	8	18-22 23-26 27-30 31-34 44-51 52-60 61- 35-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	9	prov10-12 prov11 prov2-9 prov4 prov5 prov6 prov7 prov8 prov1-3

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	19401.1531	0.7397
Scaled Deviance	26E3	16236.7808	0.6190
Pearson Chi-Square	26E3	31341.9422	1.1949
Scaled Pearson X2	26E3	26230.0000	1.0000
Log Likelihood		-9231.3013	
Full Log Likelihood		-17760.0417	
AIC (smaller is better)		35558.0833	
AICC (smaller is better)		35558.1123	
BIC (smaller is better)		35713.4156	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.8338	0.0456	-1.9233	-1.7444	1615.73	<.0001
Eta	18-22	1	0.8517	0.0411	0.7711	0.9323	428.71	<.0001
Eta	23-26	1	0.5256	0.0370	0.4531	0.5981	201.98	<.0001
Eta	27-30	1	0.2280	0.0382	0.1531	0.3028	35.63	<.0001
Eta	31-34	1	0.0974	0.0397	0.0197	0.1752	6.04	0.0140
Eta	44-51	1	0.1833	0.0339	0.1169	0.2497	29.24	<.0001
Eta	52-60	1	0.2171	0.0348	0.1489	0.2852	38.97	<.0001
Eta	61-	1	0.1193	0.0368	0.0472	0.1913	10.52	0.0012
Eta	35-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.1546	0.0208	-0.1953	-0.1138	55.28	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	-0.4636	0.0315	-0.5254	-0.4018	216.36	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	-0.2839	0.0236	-0.3302	-0.2376	144.56	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10-12	1	-0.2886	0.0480	-0.3827	-0.1945	36.16	<.0001
Prov	prov11	1	0.5033	0.0497	0.4059	0.6007	102.63	<.0001
Prov	prov2-9	1	0.3623	0.0425	0.2789	0.4456	72.51	<.0001
Prov	prov4	1	-0.0980	0.0337	-0.1640	-0.0319	8.45	0.0037
Prov	prov5	1	0.0964	0.0334	0.0309	0.1619	8.32	0.0039
Prov	prov6	1	0.1822	0.0352	0.1132	0.2513	26.77	<.0001
Prov	prov7	1	0.2032	0.0443	0.1164	0.2901	21.03	<.0001
Prov	prov8	1	0.2602	0.0308	0.1999	0.3205	71.52	<.0001

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Prov	prov1-3	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0931	0.0000	1.0931	1.0931		

Note: The scale parameter was estimated by the square root of Pearson's Chi-Square/DOF.

LR Statistics For Type 3 Analysis						
Source	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq
Eta	7	26230	74.23	<.0001	519.63	<.0001
Potkil	1	26230	54.38	<.0001	54.38	<.0001
Bendie	1	26230	193.05	<.0001	193.05	<.0001
Capoluogo	1	26230	137.69	<.0001	137.69	<.0001
Prov	8	26230	41.79	<.0001	334.33	<.0001

```
/* Modello con dati raggruppati */
/* Accorpo ulteriormente i livelli di eta */
ods select contrasts;
proc genmod data = polizzecum;
    class eta(ref='35-43') potkil bendie capoluogo prov(ref='prov1-3');
    model nsincum = eta potkil bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        scale = pearson
        type3;
    contrast "eta" eta 0  0  0  1  0  0  0 -1; /* 31-34 con 35-43 */
                   /*eta 0  0  0  0  1 -1  0  0,*/ /* 44-51 con 52-60 */
                   /*eta 0  0  0  0  0  1 -1  0;*/ /* 52-60 con 61- */
run;
```

The GENMOD Procedure

Contrast Results							
Contrast	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq	Type
eta	1	26230	5.98	0.0145	5.98	0.0145	LR

```
/* Accorpo i livelli di eta */

/* eta */
proc format;
    value classeta
        low-22 = "18-22"
        23-26 = "23-26"
        27-30 = "27-30"
        31-43 = "31-43"
        44-51 = "44-51"
        52-60 = "52-60"
        61-high = "61-";
run;

proc print data = polizze (obs = 10);
run;
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin	lnespo
1	F	31-43	prov8	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
2	M	31-43	prov5	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
3	M	44-51	prov7	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
4	F	18-22	prov10-12	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
5	M	44-51	prov2-9	NO	B	-57	-1030	8-13	0.20000	0	0.000	0	-1.60944
6	F	44-51	prov8	NO	B	-57	-1030	14-15	1.00000	0	0.000	0	0.00000
7	M	31-43	prov1-3	NO	D	-57	1031-1379	17-21	1.00000	0	0.000	0	0.00000
8	M	61-	prov1-3	SI	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
9	F	44-51	prov1-3	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin	lnespo
10	M	52-60	prov1-3	NO	B	58-	1031-1379	17-21	1.00000	1	359.057	1	0.00000

```
/* Modello di Poisson con sovradispersione definitivo */
proc genmod data = polizzecum plots = stdreschi(xbeta);
    class eta(ref='31-43') potkil bendie capoluogo prov(ref='prov1-3');
    model nsincum = eta potkil bendie capoluogo prov /
        dist = poisson
        offset = lnespocum
        scale = pearson
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZECUM
Distribution	Poisson
Link Function	Log
Dependent Variable	nsincum
Offset Variable	lnespocum

Number of Observations Read	26249
Number of Observations Used	26249

Class Level Information		
Class	Levels	Values
Eta	7	18-22 23-26 27-30 44-51 52-60 61- 31-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	9	prov10-12 prov11 prov2-9 prov4 prov5 prov6 prov7 prov8 prov1-3

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	26E3	19408.3010	0.7399
Scaled Deviance	26E3	16187.7678	0.6171
Pearson Chi-Square	26E3	31449.6198	1.1989
Scaled Pearson X2	26E3	26231.0000	1.0000
Log Likelihood		-9203.0267	
Full Log Likelihood		-17763.6156	
AIC (smaller is better)		35563.2312	
AICC (smaller is better)		35563.2573	
BIC (smaller is better)		35710.3881	

Algorithm converged.

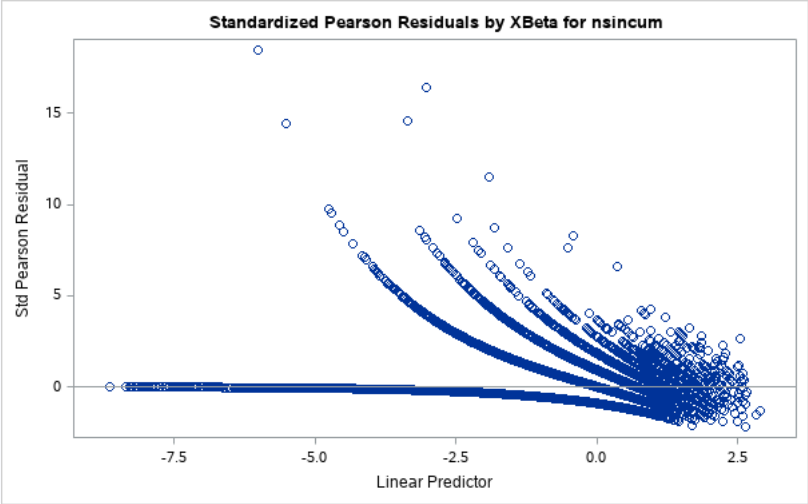
Analysis Of Maximum Likelihood Parameter Estimates							
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits	Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.7995	0.0434	-1.8845 -1.7145	1722.27	<.0001
Eta	18-22	1	0.8176	0.0386	0.7419 0.8933	448.06	<.0001
Eta	23-26	1	0.4915	0.0342	0.4245 0.5584	207.06	<.0001
Eta	27-30	1	0.1939	0.0355	0.1244 0.2634	29.88	<.0001
Eta	44-51	1	0.1492	0.0308	0.0889 0.2095	23.50	<.0001
Eta	52-60	1	0.1830	0.0317	0.1208 0.2452	33.23	<.0001
Eta	61-	1	0.0852	0.0339	0.0187 0.1517	6.31	0.0120
Eta	31-43	0	0.0000	0.0000	0.0000 0.0000	.	.
Potkil	-57	1	-0.1541	0.0208	-0.1950 -0.1133	54.76	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000 0.0000	.	.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Bendie	B	1	-0.4640	0.0316	-0.5259	-0.4021	216.03	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	-0.2840	0.0237	-0.3304	-0.2377	144.18	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10-12	1	-0.2889	0.0481	-0.3832	-0.1947	36.12	<.0001
Prov	prov11	1	0.5036	0.0498	0.4060	0.6011	102.38	<.0001
Prov	prov2-9	1	0.3622	0.0426	0.2787	0.4457	72.24	<.0001
Prov	prov4	1	-0.0977	0.0338	-0.1639	-0.0315	8.38	0.0038
Prov	prov5	1	0.0963	0.0335	0.0307	0.1619	8.27	0.0040
Prov	prov6	1	0.1819	0.0353	0.1128	0.2511	26.59	<.0001
Prov	prov7	1	0.2030	0.0444	0.1160	0.2900	20.92	<.0001
Prov	prov8	1	0.2598	0.0308	0.1994	0.3202	71.08	<.0001
Prov	prov1-3	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0950	0.0000	1.0950	1.0950		

Note: The scale parameter was estimated by the square root of Pearson's Chi-Square/DOF.

LR Statistics For Type 3 Analysis						
Source	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq
Eta	6	26231	85.32	<.0001	511.91	<.0001
Potkil	1	26231	53.87	<.0001	53.87	<.0001
Bendie	1	26231	192.73	<.0001	192.73	<.0001
Capoluogo	1	26231	137.32	<.0001	137.32	<.0001
Prov	8	26231	41.63	<.0001	333.02	<.0001

The GENMOD Procedure



3.A.1.3 Modello Binomiale Negativa

```
proc print data = polizze (obs = 10);
run;
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin	lnespo
1	F	31-43	prov8	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
2	M	31-43	prov5	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
3	M	44-51	prov7	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
4	F	18-22	prov10-12	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
5	M	44-51	prov2-9	NO	B	-57	-1030	8-13	0.20000	0	0.000	0	-1.60944
6	F	44-51	prov8	NO	B	-57	-1030	14-15	1.00000	0	0.000	0	0.00000
7	M	31-43	prov1-3	NO	D	-57	1031-1379	17-21	1.00000	0	0.000	0	0.00000

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin	lnespo
8	M	61-	prov1-3	SI	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
9	F	44-51	prov1-3	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
10	M	52-60	prov1-3	NO	B	58-	1031-1379	17-21	1.00000	1	359.057	1	0.00000

```
/* Stima preliminare di alpha */
/*ods exclude all;*/ /* Non stampo nell'output i risultati della proc genmod */
ods select ModelInfo;
proc genmod data = polizze;
    output out = stime pred = nsinatt;
    class eta(ref='31-43') potkil bendie capoluogo prov(ref='prov1-3');
    model nsin = eta potkil bendie capoluogo prov /
        dist = poisson
        offset = lnespo;
run;
/*ods exclude none;*/
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZE
Distribution	Poisson
Link Function	Log
Dependent Variable	nsin
Offset Variable	lnespo

```
proc print data = stime (obs = 10);
run;
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin	lnespo	nsinatt
1	F	31-43	prov8	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000	0.08700
2	M	31-43	prov5	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000	0.07387
3	M	44-51	prov7	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000	0.11133
4	F	18-22	prov10-12	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000	0.11383
5	M	44-51	prov2-9	NO	B	-57	-1030	8-13	0.20000	0	0.000	0	-1.60944	0.02238
6	F	44-51	prov8	NO	B	-57	-1030	14-15	1.00000	0	0.000	0	0.00000	0.10100
7	M	31-43	prov1-3	NO	D	-57	1031-1379	17-21	1.00000	0	0.000	0	0.00000	0.10671
8	M	61-	prov1-3	SI	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000	0.11323
9	F	44-51	prov1-3	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000	0.09087
10	M	52-60	prov1-3	NO	B	58-	1031-1379	17-21	1.00000	1	359.057	1	0.00000	0.09399

```
/* Stimatore di Cameron Trivedi */
/* Stimatore di Pinquet */
data alpha_dataset;
    set stime;

    /* Stimatore di Cameron Trievedi */
    add = ((nsin - nsinatt)**2 - nsinatt) / nsinatt**2;

    /* Stimatore di Pinquet */
    alphanum = nsinatt**2;
    alphaden = (nsin - nsinatt)**2 - nsinatt;

    keep nsincum nsinatt add alphanum alphaden;
run;

proc means data = alpha_dataset;
    var add alphanum alphaden;
    output out = alpha_sum sum = sadd salphanum salphaden;
run;

proc print data = alpha_sum (obs = 10);
run;
```

The MEANS Procedure

Variable	N	Mean	Std Dev	Minimum	Maximum
add	172161	37.9694385	14556.53	-6631.66	5431253.23
alphanum	172161	0.0073439	0.0087395	2.273133E-8	0.2822487
alphaden	172161	0.0057876	0.3862777	-0.3115638	23.8076966

Obs	_TYPE_	_FREQ_	sadd	salphanum	salphaden
1	0	172161	6536856.50	1264.34	996.392

```
data alpha;
    set alpha_sum;

    /* Cameron Trivedi */
    alpha_ct = (sadd / (_FREQ_ - 17))**(-1);

    /* Pinquet */
    alpha_pinquet = salphanum / salphaden;

    keep alpha_ct alpha_pinquet;
run;

proc print data = alpha noobs;
run;
```

alpha_ct	alpha_pinquet
0.026334	1.26892

```
/* Modello Binomiale Negativa con alpha stimato tramite lo stimatore di Pinquet */
proc genmod data = polizze plots = stdreschi(xbeta);
    class eta(ref='31-43') potkil bendie capoluogo prov(ref='prov1-3');

    alpha = 1.26892;
    mu = _MEAN_;
    y = _RESP_;

    variance var = mu + mu**2 / alpha;

    if y > 0 then
        d = 2 * (y * log(y / mu) - (alpha + y) * log((alpha + y) / (alpha + mu)));
    else if y = 0 then
        d = 2 * alpha * log(1 + mu / alpha);

    deviance dev = d;

    model nsin = eta potkil bendie capoluogo prov /
        link = log
        offset = lnespo;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZE
Distribution	User
Link Function	Log
Dependent Variable	nsin
Offset Variable	lnespo

Number of Observations Read	172161
Number of Observations Used	172161

Class Level Information

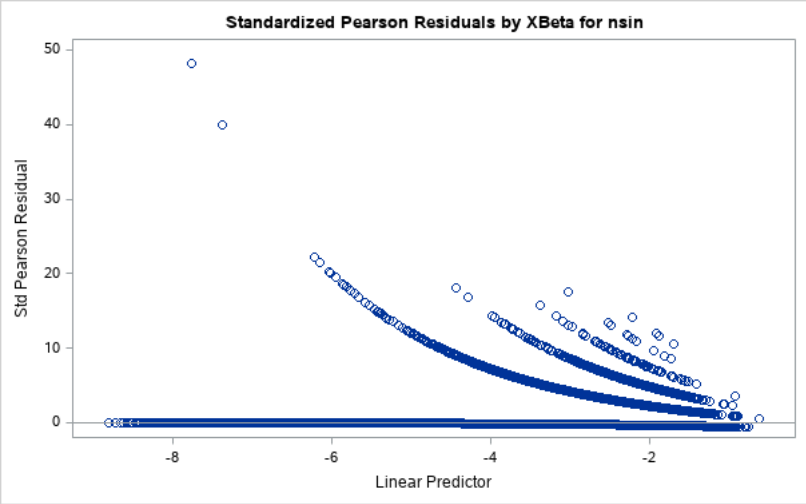
Class Level Information		
Class	Levels	Values
Eta	7	18-22 23-26 27-30 44-51 52-60 61- 31-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	9	prov10-12 prov11 prov2-9 prov4 prov5 prov6 prov7 prov8 prov1-3

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	17E4	57559.8543	0.3344
Scaled Deviance	17E4	57559.8543	0.3344
Pearson Chi-Square	17E4	192330.8433	1.1173
Scaled Pearson X2	17E4	192330.8433	1.1173
Log Likelihood		-28779.9272	
Full Log Likelihood		-28779.9272	
AIC (smaller is better)		57595.8543	
AICC (smaller is better)		57595.8583	
BIC (smaller is better)		57776.8657	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits	Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.7930	0.0414	-1.8741 -1.7118	1875.28	<.0001
Eta	18-22	1	0.8233	0.0371	0.7506 0.8961	491.88	<.0001
Eta	23-26	1	0.4948	0.0325	0.4311 0.5585	231.65	<.0001
Eta	27-30	1	0.1941	0.0335	0.1284 0.2597	33.54	<.0001
Eta	44-51	1	0.1499	0.0291	0.0930 0.2069	26.60	<.0001
Eta	52-60	1	0.1853	0.0300	0.1265 0.2441	38.11	<.0001
Eta	61-	1	0.0856	0.0320	0.0229 0.1483	7.16	0.0075
Eta	31-43	0	0.0000	0.0000	0.0000 0.0000	.	.
Potkil	-57	1	-0.1558	0.0197	-0.1945 -0.1171	62.26	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000 0.0000	.	.
Bendie	B	1	-0.4677	0.0303	-0.5271 -0.4082	237.71	<.0001
Bendie	D	0	0.0000	0.0000	0.0000 0.0000	.	.
Capoluogo	NO	1	-0.2854	0.0225	-0.3296 -0.2413	160.48	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000 0.0000	.	.
Prov	prov10-12	1	-0.2901	0.0451	-0.3784 -0.2017	41.38	<.0001
Prov	prov11	1	0.5074	0.0480	0.4134 0.6014	111.95	<.0001
Prov	prov2-9	1	0.3674	0.0407	0.2877 0.4472	81.54	<.0001
Prov	prov4	1	-0.0976	0.0318	-0.1599 -0.0352	9.40	0.0022
Prov	prov5	1	0.0974	0.0317	0.0353 0.1595	9.44	0.0021
Prov	prov6	1	0.1827	0.0334	0.1172 0.2483	29.87	<.0001
Prov	prov7	1	0.2034	0.0422	0.1208 0.2860	23.28	<.0001
Prov	prov8	1	0.2596	0.0292	0.2023 0.3169	78.90	<.0001
Prov	prov1-3	0	0.0000	0.0000	0.0000 0.0000	.	.
Scale		0	1.0000	0.0000	1.0000 1.0000		

Note: The scale parameter was held fixed.




```
/* Modello Binomiale Negativa con alpha stimato tramite la massima verosimiglianza */
proc genmod data = polizze plots = stdreschi(xbeta);
    class eta(ref='31-43') potkil bendie capoluogo prov(ref='prov1-3');

    model nsin = eta potkil bendie capoluogo prov /
        dist = negbin
        link = log
        offset = lnespo;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.POLIZZE
Distribution	Negative Binomial
Link Function	Log
Dependent Variable	nsin
Offset Variable	lnespo

Number of Observations Read	172161
Number of Observations Used	172161

Class Level Information		
Class	Levels	Values
Eta	7	18-22 23-26 27-30 44-51 52-60 61- 31-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	9	prov10-12 prov11 prov2-9 prov4 prov5 prov6 prov7 prov8 prov1-3

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	17E4	57409.2051	0.3335
Scaled Deviance	17E4	57409.2051	0.3335
Pearson Chi-Square	17E4	192096.0927	1.1159
Scaled Pearson X2	17E4	192096.0927	1.1159
Log Likelihood		-44017.1675	
Full Log Likelihood		-44721.6472	
AIC (smaller is better)		89481.2943	
AICC (smaller is better)		89481.2987	
BIC (smaller is better)		89672.3618	

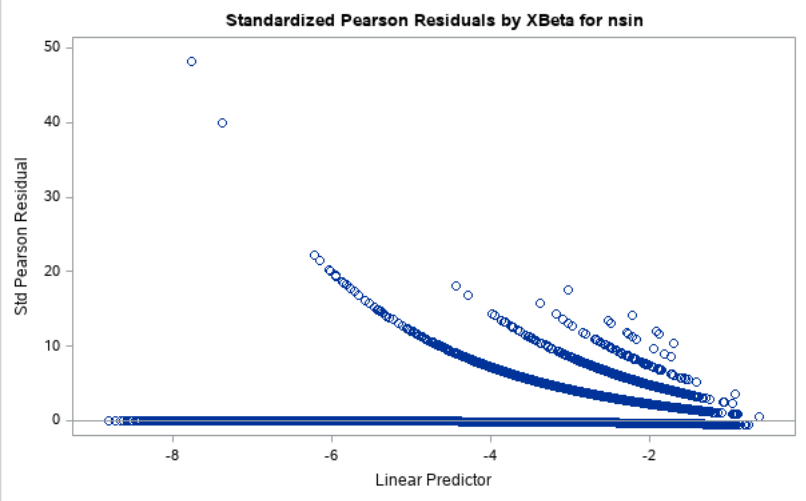
Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	-1.7928	0.0414	-1.8741	-1.7116	1871.02	<.0001
Eta	18-22	1	0.8235	0.0372	0.7506	0.8963	490.85	<.0001
Eta	23-26	1	0.4949	0.0325	0.4311	0.5586	231.28	<.0001
Eta	27-30	1	0.1941	0.0335	0.1283	0.2598	33.49	<.0001
Eta	44-51	1	0.1499	0.0291	0.0929	0.2070	26.56	<.0001
Eta	52-60	1	0.1853	0.0300	0.1265	0.2442	38.07	<.0001
Eta	61-	1	0.0856	0.0320	0.0228	0.1484	7.15	0.0075
Eta	31-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.1559	0.0198	-0.1946	-0.1171	62.18	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	-0.4677	0.0304	-0.5273	-0.4082	237.23	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	-0.2854	0.0226	-0.3296	-0.2412	160.21	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10-12	1	-0.2901	0.0451	-0.3785	-0.2017	41.34	<.0001
Prov	prov11	1	0.5075	0.0480	0.4134	0.6016	111.71	<.0001
Prov	prov2-9	1	0.3676	0.0407	0.2877	0.4474	81.42	<.0001
Prov	prov4	1	-0.0975	0.0318	-0.1600	-0.0351	9.38	0.0022
Prov	prov5	1	0.0974	0.0317	0.0352	0.1596	9.43	0.0021
Prov	prov6	1	0.1827	0.0335	0.1171	0.2483	29.82	<.0001
Prov	prov7	1	0.2034	0.0422	0.1207	0.2861	23.24	<.0001
Prov	prov8	1	0.2596	0.0293	0.2023	0.3169	78.76	<.0001
Prov	prov1-3	0	0.0000	0.0000	0.0000	0.0000	.	.
Dispersion		1	0.8069	0.0589	0.6993	0.9310		

Note: The negative binomial dispersion parameter was estimated by maximum likelihood.

The GENMOD Procedure



3.A.2 Modelli per il danno per sinistro

Preparazione dei dati

```
data danni;
    set dati.danni;
run;

proc print data = danni (obs = 10);
run;
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	danno

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	danno
1	M	55	AR	NO	B	80	1180	18	359.06
2	M	56	TE	NO	B	55	1120	17	1617.55
3	F	33	VC	NO	B	36	795	14	179.53
4	F	56	BL	NO	B	66	1050	17	691.19
5	M	73	MS	NO	B	36	765	13	1617.55
6	M	61	VI	NO	B	77	1200	18	1201.05
7	F	31	BA	NO	B	52	990	15	538.59
8	M	37	VR	NO	B	103	1420	20	359.06
9	F	53	FO	NO	B	25	700	10	6059.09
10	M	70	FI	NO	B	65	1010	17	771.97

```
/* Applico la partizione in livelli definita precedentemente */
data danni;
    set danni;
    format prov $classprov.;
    format eta classeta.;
    format potf classpotf.;
    format potkil classpotkil.;
    format massa classmassa.;
run;

proc print data = danni (obs = 10);
run;
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	danno
1	M	52-60	prov1-3	NO	B	58-	1031-1379	17-21	359.06
2	M	52-60	prov1-3	NO	B	-57	1031-1379	17-21	1617.55
3	F	31-43	prov1-3	NO	B	-57	-1030	14-15	179.53
4	F	52-60	prov10-12	NO	B	58-	1031-1379	17-21	691.19
5	M	61-	prov7	NO	B	-57	-1030	8-13	1617.55
6	M	61-	prov1-3	NO	B	58-	1031-1379	17-21	1201.05
7	F	31-43	prov2-9	NO	B	-57	-1030	14-15	538.59
8	M	31-43	prov1-3	NO	B	58-	1380-1424	17-21	359.06
9	F	52-60	prov6	NO	B	-57	-1030	8-13	6059.09
10	M	61-	prov8	NO	B	58-	-1030	17-21	771.97

```
/* Dataset per modelli con dati raggruppati */
proc means data = danni nway noprint;
    class sesso capoluogo bendie prov eta potf potkil massa;
    var danno;
    output out = dannicum sum = dannocum;
run;

data dannicum;
    set dannicum;
    dannocummed = dannocum / _FREQ_;

    rename _FREQ_ = nsin;
    drop _TYPE_;
run;

proc print data = dannicum (obs = 10);
run;
```

Obs	Sesso	Capoluogo	Bendie	Prov	Eta	potf	Potkil	Massa	nsin	dannocum	dannocummed
1	F	NO	B	prov1-3	18-22	8-13	-57	-1030	46	128088.48	2784.53
2	F	NO	B	prov1-3	18-22	8-13	58-	-1030	1	987.41	987.41
3	F	NO	B	prov1-3	18-22	14-15	-57	-1030	16	54461.79	3403.86
4	F	NO	B	prov1-3	18-22	14-15	58-	-1030	2	2441.95	1220.97
5	F	NO	B	prov1-3	18-22	16	-57	-1030	2	4372.42	2186.21

Obs	Sesso	Capoluogo	Bendie	Prov	Eta	potf	Potkil	Massa	nsin	dannocum	dannocummed
6	F	NO	B	prov1-3	18-22	16	58-	-1030	1	10322.89	10322.89
7	F	NO	B	prov1-3	18-22	17-21	-57	1031-1379	1	556.54	556.54
8	F	NO	B	prov1-3	18-22	17-21	58-	1031-1379	2	3551.08	1775.54
9	F	NO	B	prov1-3	23-26	8-13	-57	-1030	62	151011.33	2435.67
10	F	NO	B	prov1-3	23-26	14-15	-57	-1030	26	33844.04	1301.69

```
/* Il dataset dannicum ha 2 249 righe */
proc summary data = dannicum;
    output out = conta_righe;
run;

proc print data = conta_righe;
run;
```

Obs	_TYPE_	_FREQ_
1	0	2249

3.A.2.1 Modello Gamma

```
/* Modello con dati individuali */
proc genmod data = danni;
    class eta(ref='31-43') potkil bendie capoluogo prov(ref='prov1-3');
    model danno = eta potkil bendie capoluogo prov /
        dist = gamma
        link = log
        type3;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.DANNI
Distribution	Gamma
Link Function	Log
Dependent Variable	danno

Number of Observations Read	12691
Number of Observations Used	12691

Class Level Information		
Class	Levels	Values
Eta	7	18-22 23-26 27-30 44-51 52-60 61- 31-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	9	prov10-12 prov11 prov2-9 prov4 prov5 prov6 prov7 prov8 prov1-3

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	13E3	17803.3419	1.4048
Scaled Deviance	13E3	14967.0467	1.1810
Pearson Chi-Square	13E3	114315.2165	9.0204
Scaled Pearson X2	13E3	96103.3714	7.5833
Log Likelihood		-113894.6875	
Full Log Likelihood		-113894.6875	
AIC (smaller is better)		227827.3751	
AICC (smaller is better)		227827.4350	
BIC (smaller is better)		227968.8994	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	7.8570	0.0436	7.7715	7.9425	32459.9	<.0001
Eta	18-22	1	0.2319	0.0386	0.1563	0.3075	36.13	<.0001
Eta	23-26	1	0.1630	0.0341	0.0961	0.2299	22.82	<.0001
Eta	27-30	1	0.1060	0.0355	0.0364	0.1757	8.90	0.0028
Eta	44-51	1	-0.1213	0.0307	-0.1815	-0.0610	15.57	<.0001
Eta	52-60	1	-0.0216	0.0317	-0.0838	0.0405	0.47	0.4950
Eta	61-	1	-0.0662	0.0341	-0.1329	0.0006	3.77	0.0522
Eta	31-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.2019	0.0208	-0.2427	-0.1611	94.08	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	0.1309	0.0315	0.0691	0.1927	17.24	<.0001
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	0.1143	0.0237	0.0678	0.1607	23.23	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10-12	1	0.2506	0.0480	0.1565	0.3446	27.25	<.0001
Prov	prov11	1	-0.2226	0.0502	-0.3209	-0.1243	19.68	<.0001
Prov	prov2-9	1	-0.1788	0.0427	-0.2625	-0.0951	17.54	<.0001
Prov	prov4	1	0.1136	0.0337	0.0476	0.1796	11.37	0.0007
Prov	prov5	1	0.1024	0.0335	0.0368	0.1680	9.35	0.0022
Prov	prov6	1	0.2153	0.0354	0.1460	0.2846	37.09	<.0001
Prov	prov7	1	0.0076	0.0443	-0.0792	0.0944	0.03	0.8633
Prov	prov8	1	-0.0222	0.0308	-0.0826	0.0382	0.52	0.4713
Prov	prov1-3	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		1	0.8407	0.0091	0.8229	0.8588		

Note: The scale parameter was estimated by maximum likelihood.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	6	123.98	<.0001
Potkil	1	95.58	<.0001
Bendie	1	16.69	<.0001
Capoluogo	1	22.78	<.0001
Prov	8	141.13	<.0001

```
/* Modello con dati raggruppati */
proc genmod data = dannicum;
    class eta(ref='31-43') potkil bendie capoluogo prov(ref='prov1-3');
    model dannocummed = eta potkil bendie capoluogo prov /
        dist = gamma
        link = log
        type3;
    weight nsin;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.DANNICUM
Distribution	Gamma
Link Function	Log
Dependent Variable	dannocummed
Scale Weight Variable	nsin

Number of Observations Read	2249

Number of Observations Used	2249
Sum of Weights	12691

Class Level Information		
Class	Levels	Values
Eta	7	18-22 23-26 27-30 44-51 52-60 61- 31-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	9	prov10-12 prov11 prov2-9 prov4 prov5 prov6 prov7 prov8 prov1-3

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	2231	5247.0680	2.3519
Scaled Deviance	2231	2607.1966	1.1686
Pearson Chi-Square	2231	14042.0724	6.2941
Scaled Pearson X2	2231	6977.3144	3.1274
Log Likelihood		-20173.9912	
Full Log Likelihood		-20173.9912	
AIC (smaller is better)		40385.9824	
AICC (smaller is better)		40386.3234	
BIC (smaller is better)		40494.6290	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	7.8570	0.0567	7.7458	7.9682	19185.3	<.0001
Eta	18-22	1	0.2319	0.0502	0.1335	0.3302	21.35	<.0001
Eta	23-26	1	0.1630	0.0444	0.0760	0.2500	13.49	0.0002
Eta	27-30	1	0.1060	0.0462	0.0154	0.1967	5.26	0.0218
Eta	44-51	1	-0.1213	0.0400	-0.1996	-0.0429	9.20	0.0024
Eta	52-60	1	-0.0216	0.0413	-0.1025	0.0592	0.28	0.5999
Eta	61-	1	-0.0662	0.0443	-0.1530	0.0207	2.23	0.1355
Eta	31-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.2019	0.0271	-0.2550	-0.1489	55.61	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	0.1309	0.0410	0.0505	0.2113	10.19	0.0014
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	0.1143	0.0308	0.0538	0.1747	13.73	0.0002
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10-12	1	0.2506	0.0624	0.1282	0.3729	16.11	<.0001
Prov	prov11	1	-0.2226	0.0653	-0.3505	-0.0947	11.63	0.0006
Prov	prov2-9	1	-0.1788	0.0555	-0.2877	-0.0700	10.36	0.0013
Prov	prov4	1	0.1136	0.0438	0.0277	0.1994	6.72	0.0095
Prov	prov5	1	0.1024	0.0436	0.0170	0.1878	5.53	0.0187
Prov	prov6	1	0.2153	0.0460	0.1252	0.3055	21.92	<.0001
Prov	prov7	1	0.0076	0.0576	-0.1053	0.1206	0.02	0.8947
Prov	prov8	1	-0.0222	0.0401	-0.1008	0.0564	0.31	0.5797
Prov	prov1-3	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		1	0.4969	0.0131	0.4719	0.5232		

Note: The scale parameter was estimated by maximum likelihood.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
Eta	6	72.63	<.0001

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
Potkil	1	56.11	<.0001
Bendie	1	9.85	0.0017
Capoluogo	1	13.44	0.0002
Prov	8	82.57	<.0001

```
/* Testo accorpamenti eta */
ods select contrasts;
proc genmod data = dannicum;
    class eta(ref='31-43') potkil bendie capoluogo prov(ref='prov1-3');
    model dannocummed = eta potkil bendie capoluogo prov /
        dist = gamma
        link = log
        type3;
    weight nsin;
    contrast "eta" eta  1 -1  0  0  0  0  0, /* 18-22 con 23-26 */
                   eta  0  0  1  0  0  0 -1, /* 27-30 con 31-43 */
                   eta  0  0  0  1 -1  0  0, /* 44-51 con 52-60 */
                   eta  0  0  0  0  1 -1  0; /* 52-60 con 61- */

run;
```

The GENMOD Procedure

Contrast Results				
Contrast	**DF**	**Chi-Square**	**Pr > ChiSq**	**Type**
eta	4	11.63	0.0203	LR

```
/* Ulteriori accorpamenti di variabili */
/* eta */
proc format;
    value classeta
        low-26 = "18-26"
        27-43 = "27-43"
        44-high = "44-";
run;

proc print data = polizze (obs = 10);
run;
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin	lnespo
1	F	27-43	prov8	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
2	M	27-43	prov5	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
3	M	44-	prov7	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
4	F	18-26	prov10-12	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
5	M	44-	prov2-9	NO	B	-57	-1030	8-13	0.20000	0	0.000	0	-1.60944
6	F	44-	prov8	NO	B	-57	-1030	14-15	1.00000	0	0.000	0	0.00000
7	M	27-43	prov1-3	NO	D	-57	1031-1379	17-21	1.00000	0	0.000	0	0.00000
8	M	44-	prov1-3	SI	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
9	F	44-	prov1-3	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
10	M	44-	prov1-3	NO	B	58-	1031-1379	17-21	1.00000	1	359.057	1	0.00000

```
proc genmod data = dannicum;
    class eta(ref='27-43') potkil bendie capoluogo prov(ref='prov1-3');
    model dannocummed = eta potkil bendie capoluogo prov /
        dist = gamma
        link = log
        type3;
    weight nsin;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.DANNICUM
Distribution	Gamma
Link Function	Log
Dependent Variable	dannocummed
Scale Weight Variable	nsin

Number of Observations Read	2249
Number of Observations Used	2249
Sum of Weights	12691

Class Level Information		
Class	Levels	Values
Eta	3	18-26 44- 27-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	9	prov10-12 prov11 prov2-9 prov4 prov5 prov6 prov7 prov8 prov1-3

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	2235	5270.5175	2.3582
Scaled Deviance	2235	2608.3318	1.1670
Pearson Chi-Square	2235	14183.7232	6.3462
Scaled Pearson X2	2235	7019.3974	3.1407
Log Likelihood		-20179.8054	
Full Log Likelihood		-20179.8054	
AIC (smaller is better)		40389.6107	
AICC (smaller is better)		40389.8257	
BIC (smaller is better)		40475.3844	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	7.8888	0.0554	7.7803	7.9973	20292.3	<.0001
Eta	18-26	1	0.1602	0.0351	0.0915	0.2290	20.87	<.0001
Eta	44-	1	-0.1030	0.0286	-0.1589	-0.0470	13.00	0.0003
Eta	27-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.2030	0.0269	-0.2558	-0.1502	56.84	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	0.1303	0.0411	0.0498	0.2109	10.06	0.0015
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	0.1183	0.0308	0.0579	0.1787	14.72	0.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov10-12	1	0.2544	0.0625	0.1320	0.3769	16.58	<.0001
Prov	prov11	1	-0.2284	0.0653	-0.3564	-0.1004	12.23	0.0005
Prov	prov2-9	1	-0.1774	0.0555	-0.2862	-0.0685	10.20	0.0014
Prov	prov4	1	0.1049	0.0438	0.0190	0.1907	5.73	0.0167
Prov	prov5	1	0.0992	0.0435	0.0139	0.1844	5.20	0.0226
Prov	prov6	1	0.2181	0.0459	0.1281	0.3082	22.55	<.0001
Prov	prov7	1	0.0079	0.0577	-0.1051	0.1210	0.02	0.8907
Prov	prov8	1	-0.0251	0.0400	-0.1035	0.0533	0.39	0.5303
Prov	prov1-3	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		1	0.4949	0.0130	0.4700	0.5211		

Note: The scale parameter was estimated by maximum likelihood.

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
Eta	2	61.00	<.0001
Potkil	1	57.39	<.0001
Bendie	1	9.73	0.0018
Capoluogo	1	14.40	0.0001
Prov	8	83.49	<.0001

```
/* Test per accorpamenti province */
ods select contrasts;
proc genmod data = dannicum;
    class eta(ref='27-43') potkil bendie capoluogo prov(ref='prov1-3');
    model dannocummed = eta potkil bendie capoluogo prov /
        dist = gamma
        link = log;
    weight nsin;
    contrasts "province" prov  0  0  0  0  0  0  1  0 -1, /* prov8 con prov1-3 */
                         prov  0  0  0  0  0  0  0  1 -1, /* prov7 con prov1-3 */
                         prov  0  0  0  1 -1  0  0  0  0, /* prov4 con prov5 */
                         prov  1  0  0  0  0 -1  0  0  0, /* prov6 con prov10-12 */
                         prov  0  1 -1  0  0  0  0  0  0; /* prov11 con prov2-9 */
run;
```

The GENMOD Procedure

Contrast Results				
Contrast	**DF**	**Chi-Square**	**Pr > ChiSq**	**Type**
province	5	1.23	0.9424	LR

```
/* prov */
proc format;
    value $classprov

"RC","VT","CN","OR","RA","VC","FE","LC","SS","VV","BZ","PV","RG","CH","PG","AR","TE","TN","VR","EN","NO","SV","VI","MC","MT","RE
","BS","RI","AG","AV","PC","LE","RN","AN","MS","BO","GE","TS","CB","FI","NU","PE","TO","MI" = "prov1-3-7-8"
        "BN","PO","IM","BA","PT","TA","SP","CA","ROMA","PA","AO","NA","CE","KR" = "prov2-9-11"

"AL","SO","GO","LT","PR","PN","GR","UD","TV","PD","SI","TR","AP","LO","FG","ME","LU","CZ","FR","CT","VE","BG","IS","MO","TP" =
"prov4-5"
        "CL","PI","VA","BR","FO","LI","SR","CO","SA","BL","PZ","BI","CR","CS","AT","MN","PS","AQ","RSM","VB","RO" = "prov6-10-
12"
run;

proc print data = polizze (obs = 10);
run;
```

Obs	Sesso	Eta	Prov	Capoluogo	Bendie	Potkil	Massa	potf	espo	nsin	dannotot	freqsin	lnespo
1	F	27-43	prov1-3-7-8	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
2	M	27-43	prov4-5	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
3	M	44-	prov1-3-7-8	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
4	F	18-26	prov6-10-12 run	NO	B	-57	-1030	8-13	1.00000	0	0.000	0	0.00000
5	M	44-	prov2-9-11	NO	B	-57	-1030	8-13	0.20000	0	0.000	0	-1.60944
6	F	44-	prov1-3-7-8	NO	B	-57	-1030	14-15	1.00000	0	0.000	0	0.00000
7	M	27-43	prov1-3-7-8	NO	D	-57	1031-1379	17-21	1.00000	0	0.000	0	0.00000
8	M	44-	prov1-3-7-8	SI	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
9	F	44-	prov1-3-7-8	NO	B	58-	-1030	14-15	1.00000	0	0.000	0	0.00000
10	M	44-	prov1-3-7-8	NO	B	58-	1031-1379	17-21	1.00000	1	359.057	1	0.00000

```
proc genmod data = dannicum plots = stdreschi(xbeta);
    class eta(ref='27-43') potkil bendie capoluogo prov(ref='prov1-3-7-8');
    model dannocummed = eta potkil bendie capoluogo prov /
        dist = gamma
```

```
        link = log
        type3;
    weight nsin;
run;
```

The GENMOD Procedure

Model Information	
Data Set	WORK.DANNICUM
Distribution	Gamma
Link Function	Log
Dependent Variable	dannocummed
Scale Weight Variable	nsin

Number of Observations Read	2249
Number of Observations Used	2249
Sum of Weights	12691

Class Level Information		
Class	Levels	Values
Eta	3	18-26 44- 27-43
Potkil	2	-57 58-
Bendie	2	B D
Capoluogo	2	NO SI
Prov	4	prov2-9-11 prov4-5 prov6-10-12 run prov1-3-7-8

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	2240	5272.9949	2.3540
Scaled Deviance	2240	2608.4516	1.1645
Pearson Chi-Square	2240	14116.3074	6.3019
Scaled Pearson X2	2240	6983.0724	3.1174
Log Likelihood		-20180.4183	
Full Log Likelihood		-20180.4183	
AIC (smaller is better)		40380.8365	
AICC (smaller is better)		40380.9348	
BIC (smaller is better)		40438.0189	

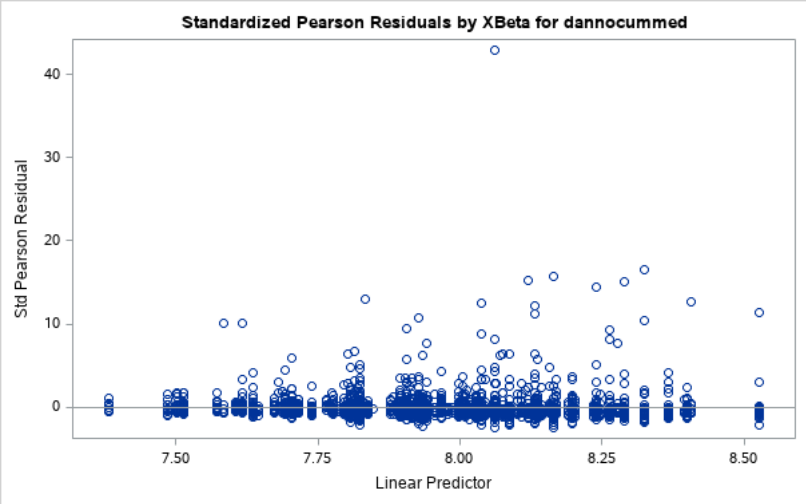
Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	7.8775	0.0518	7.7760	7.9790	23119.8	<.0001
Eta	18-26	1	0.1592	0.0351	0.0905	0.2279	20.61	<.0001
Eta	44-	1	-0.1031	0.0285	-0.1590	-0.0472	13.07	0.0003
Eta	27-43	0	0.0000	0.0000	0.0000	0.0000	.	.
Potkil	-57	1	-0.2028	0.0269	-0.2555	-0.1500	56.78	<.0001
Potkil	58-	0	0.0000	0.0000	0.0000	0.0000	.	.
Bendie	B	1	0.1324	0.0409	0.0522	0.2125	10.46	0.0012
Bendie	D	0	0.0000	0.0000	0.0000	0.0000	.	.
Capoluogo	NO	1	0.1209	0.0305	0.0610	0.1807	15.65	<.0001
Capoluogo	SI	0	0.0000	0.0000	0.0000	0.0000	.	.
Prov	prov2-9-11	1	-0.1897	0.0425	-0.2729	-0.1064	19.92	<.0001
Prov	prov4-5	1	0.1095	0.0312	0.0484	0.1707	12.33	0.0004
Prov	prov6-10-12 run	1	0.2369	0.0369	0.1645	0.3093	41.12	<.0001
Prov	prov1-3-7-8	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		1	0.4947	0.0130	0.4698	0.5209		

Note: The scale parameter was estimated by maximum likelihood.

LR Statistics For Type 3 Analysis			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
Eta	2	60.76	<.0001
Potkil	1	57.34	<.0001
Bendie	1	10.11	0.0015
Capoluogo	1	15.29	<.0001
Prov	3	82.27	<.0001

The GENMOD Procedure



4) Riservazione con i GLM

Preparazione dei dati

```
data runoff;
    set dati.runoff;
run;

proc print data = runoff (obs = 10);
run;
```

Obs	pagamenti	nden	annoacc	annodiff	annopag
1	10775462	32165	0	0	0
2	9159050	32165	0	1	1
3	2581795	32165	0	2	2
4	1380284	32165	0	3	3
5	871723	32165	0	4	4
6	589888	32165	0	5	5
7	1275556	32165	0	6	6
8	1643537	32165	0	7	7
9	522288	32165	0	8	8
10	645271	32165	0	9	9

```
/*
Riporto:
- pagamentinden: pagamenti incrementali in rapporto al numero di sinistri denunciati
- logpagamenti: logaritmo dei pagamenti
*/
data runoff1;
    set runoff;
    pagamentinden = pagamenti / nden;
    logpagamenti = log(pagamenti);
run;

proc print data = runoff1 (obs = 10);
run;
```

Obs	pagamenti	nden	annoacc	annodiff	annopag	pagamentinden	logpagamenti
1	10775462	32165	0	0	0	335.006	16.1928
2	9159050	32165	0	1	1	284.752	16.0303
3	2581795	32165	0	2	2	80.267	14.7640
4	1380284	32165	0	3	3	42.913	14.1378
5	871723	32165	0	4	4	27.102	13.6782
6	589888	32165	0	5	5	18.339	13.2877
7	1275556	32165	0	6	6	39.657	14.0589
8	1643537	32165	0	7	7	51.097	14.3124
9	522288	32165	0	8	8	16.238	13.1660
10	645271	32165	0	9	9	20.061	13.3774

Modello Poisson-Logaritmo

- Variabili risposta: $Y_i = P_{ij}$ (`pagamenti`), con distribuzione di **Poisson**;
- Variabili esplicative: i (`annoacc`) e j (`annodiff`), di classificazione $\eta_{ij} = \boldsymbol{x}'\beta = \mu + \alpha_i + \beta_j$;
- Funzione di collegamento: $g = log$.

```
proc genmod data = runoff1;
    class annoacc (ref = first) annodiff (ref = first);
    model pagamenti = annoacc annodiff /
        dist = poisson
        link = log
        type3;
run;
```

The GENMOD Procedure

Model Information		
Data Set	WORK.RUNOFF1	
Distribution	Poisson	
Link Function	Log	
Dependent Variable	pagamenti	pagamenti

Number of Observations Read	105
Number of Observations Used	105

Class Level Information		
Class	Levels	Values
annoacc	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0
annodiff	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	78	14260424.598	182825.9564
Scaled Deviance	78	14260424.598	182825.9564
Pearson Chi-Square	78	14447110.935	185219.3710
Scaled Pearson X2	78	14447110.935	185219.3710
Log Likelihood		9218270255.4	
Full Log Likelihood		-7131082.019	
AIC (smaller is better)		14262218.039	
AICC (smaller is better)		14262237.675	
BIC (smaller is better)		14262289.696	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	16.1578	0.0002	16.1574	16.1581	7.225E9	<.0001

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
annoacc	1	1	0.1685	0.0002	0.1681	0.1690	473998	<.0001
annoacc	2	1	0.3099	0.0002	0.3095	0.3104	1688300	<.0001
annoacc	3	1	0.1911	0.0002	0.1906	0.1916	605889	<.0001
annoacc	4	1	0.2646	0.0002	0.2641	0.2650	1191696	<.0001
annoacc	5	1	0.4359	0.0002	0.4354	0.4364	3451576	<.0001
annoacc	6	1	0.5303	0.0002	0.5299	0.5308	5257320	<.0001
annoacc	7	1	0.5360	0.0002	0.5355	0.5364	5290452	<.0001
annoacc	8	1	0.6910	0.0002	0.6906	0.6915	9217844	<.0001
annoacc	9	1	0.7318	0.0002	0.7314	0.7323	1.034E7	<.0001
annoacc	10	1	0.8491	0.0002	0.8487	0.8496	1.427E7	<.0001
annoacc	11	1	0.7718	0.0002	0.7713	0.7722	1.114E7	<.0001
annoacc	12	1	0.7203	0.0002	0.7198	0.7207	8877816	<.0001
annoacc	13	1	0.7465	0.0003	0.7460	0.7471	6821783	<.0001
annoacc	0	0	0.0000	0.0000	0.0000	0.0000	.	.
annodiff	1	1	-0.0887	0.0001	-0.0889	-0.0886	847441	<.0001
annodiff	2	1	-1.1171	0.0001	-1.1173	-1.1168	6.342E7	<.0001
annodiff	3	1	-1.7941	0.0002	-1.7945	-1.7937	8.443E7	<.0001
annodiff	4	1	-2.3215	0.0003	-2.3220	-2.3209	7.675E7	<.0001
annodiff	5	1	-2.3994	0.0003	-2.4000	-2.3988	6.61E7	<.0001
annodiff	6	1	-2.7240	0.0004	-2.7247	-2.7232	5.33E7	<.0001
annodiff	7	1	-2.2936	0.0003	-2.2942	-2.2929	4.818E7	<.0001
annodiff	8	1	-3.0068	0.0005	-3.0078	-3.0058	3.435E7	<.0001
annodiff	9	1	-3.2233	0.0006	-3.2246	-3.2221	2.552E7	<.0001
annodiff	10	1	-3.3294	0.0008	-3.3309	-3.3279	1.93E7	<.0001
annodiff	11	1	-3.6627	0.0010	-3.6647	-3.6607	1.255E7	<.0001
annodiff	12	1	-3.1271	0.0010	-3.1291	-3.1251	9564465	<.0001
annodiff	13	1	-2.3422	0.0010	-2.3442	-2.3402	5294849	<.0001
annodiff	0	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

LR Statistics For Type 3 Analysis			
Source	DF	Chi-Square	Pr > ChiSq
annoacc	13	3.667E7	<.0001
annodiff	13	4.948E8	<.0001

Modello Gamma-Logaritmo

- Variabili risposta: $Y_i = P_{ij}$ (pagamenti), con distribuzione **gamma**;
- Variabili esplicative: i (annoacc) e j (annodiff), di classificazione $\eta_{ij} = \boldsymbol{x}'\beta = \mu + \alpha_i + \beta_j$;
- Funzione di collegamento: $g = log$.

```
proc genmod data = runoff1;
    class annoacc (ref = first) annodiff (ref = first);
    model pagamenti = annoacc annodiff /
        dist = gamma
        link = log
        scale = pearson
        type3;
run;
```

The GENMOD Procedure

Model Information		
Data Set	WORK.RUNOFF1	
Distribution	Gamma	
Link Function	Log	
Dependent Variable	pagamenti	pagamenti

Number of Observations Read	105
Number of Observations Used	105

Class Level Information		
Class	Levels	Values
annoacc	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0
annodiff	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	78	9.9323	0.1273
Scaled Deviance	78	88.4751	1.1343
Pearson Chi-Square	78	8.7563	0.1123
Scaled Pearson X2	78	78.0000	1.0000
Log Likelihood		-1573.3582	
Full Log Likelihood		-1573.3582	
AIC (smaller is better)		3200.7164	
AICC (smaller is better)		3220.3528	
BIC (smaller is better)		3272.3733	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	16.3646	0.1400	16.0903	16.6390	13666.4	<.0001
annoacc	1	1	0.2396	0.1320	-0.0191	0.4983	3.29	0.0695
annoacc	2	1	0.2364	0.1377	-0.0334	0.5062	2.95	0.0859
annoacc	3	1	-0.0378	0.1415	-0.3151	0.2395	0.07	0.7893
annoacc	4	1	-0.0195	0.1477	-0.3091	0.2700	0.02	0.8947
annoacc	5	1	0.1012	0.1534	-0.1995	0.4020	0.44	0.5095
annoacc	6	1	0.1889	0.1590	-0.1227	0.5005	1.41	0.2348
annoacc	7	1	0.3370	0.1657	0.0122	0.6617	4.14	0.0420
annoacc	8	1	0.4124	0.1759	0.0677	0.7572	5.50	0.0190
annoacc	9	1	0.4317	0.1873	0.0646	0.7988	5.31	0.0212
annoacc	10	1	0.6940	0.2032	0.2959	1.0922	11.67	0.0006
annoacc	11	1	0.6255	0.2270	0.1806	1.0704	7.59	0.0059
annoacc	12	1	0.5253	0.2675	0.0009	1.0496	3.85	0.0496
annoacc	13	1	0.5396	0.3631	-0.1721	1.2513	2.21	0.1372
annoacc	0	0	0.0000	0.0000	0.0000	0.0000	.	.
annodiff	1	1	-0.1047	0.1315	-0.3625	0.1530	0.63	0.4258
annodiff	2	1	-1.1463	0.1355	-1.4119	-0.8808	71.57	<.0001
annodiff	3	1	-1.7918	0.1395	-2.0653	-1.5183	164.87	<.0001
annodiff	4	1	-2.2928	0.1438	-2.5747	-2.0109	254.07	<.0001
annodiff	5	1	-2.4195	0.1498	-2.7131	-2.1259	260.93	<.0001
annodiff	6	1	-2.7622	0.1560	-3.0679	-2.4564	313.52	<.0001
annodiff	7	1	-2.3163	0.1632	-2.6362	-1.9965	201.46	<.0001
annodiff	8	1	-3.0787	0.1727	-3.4171	-2.7403	317.93	<.0001
annodiff	9	1	-3.3611	0.1859	-3.7255	-2.9966	326.74	<.0001
annodiff	10	1	-3.4670	0.2027	-3.8644	-3.0697	292.44	<.0001
annodiff	11	1	-3.8490	0.2256	-4.2911	-3.4069	291.13	<.0001
annodiff	12	1	-3.3855	0.2673	-3.9093	-2.8616	160.41	<.0001
annodiff	13	1	-2.5491	0.3631	-3.2608	-1.8374	49.28	<.0001
annodiff	0	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	8.9078	0.0000	8.9078	8.9078		

Note: The Gamma scale parameter was estimated by DOF/Pearson's Chi-Square

Lagrange Multiplier Statistics

Parameter	Lagrange Multiplier Statistics Chi-Square	Pr > ChiSq
Scale	Chi-Square 5669	Pr > C2159

LR Statistics For Type 3 Analysis						
Source	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq
annoacc	13	78	2.52	0.0061	32.80	0.0018
annodiff	13	78	84.19	<.0001	1094.46	<.0001

Modello di Poisson con Sovradispersione-Logaritmo

- Variabili risposta: $Y_i = P_{ij}$ (`pagamenti`), **Poisson con Sovradispersione**;
- Variabili esplicative: i (`annoacc`) e j (`annodiff`), di classificazione $\eta_{ij} = \boldsymbol{x}'\beta = \mu + \alpha_i + \beta_j$;
- Funzione di collegamento: $g = log$.

```
proc genmod data = runoff1;
    class annoacc (ref = first) annodiff (ref = first);
    model pagamenti = annoacc annodiff /
        dist = poisson
        link = log
        scale = pearson
        type3;
run;
```

The GENMOD Procedure

Model Information		
Data Set	WORK.RUNOFF1	
Distribution	Poisson	
Link Function	Log	
Dependent Variable	pagamenti	pagamenti

Number of Observations Read	105
Number of Observations Used	105

Class Level Information		
Class	Levels	Values
annoacc	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0
annodiff	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	78	14260424.598	182825.9564
Scaled Deviance	78	76.9921	0.9871
Pearson Chi-Square	78	14447110.935	185219.3710
Scaled Pearson X2	78	78.0000	1.0000
Log Likelihood		49769.4718	
Full Log Likelihood		-7131082.019	
AIC (smaller is better)		14262218.039	
AICC (smaller is better)		14262237.675	
BIC (smaller is better)		14262289.696	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	16.1578	0.0818	15.9974	16.3181	39008.2	<.0001
annoacc	1	1	0.1685	0.1054	-0.0380	0.3750	2.56	0.1097
annoacc	2	1	0.3099	0.1027	0.1087	0.5111	9.12	0.0025
annoacc	3	1	0.1911	0.1057	-0.0160	0.3982	3.27	0.0705
annoacc	4	1	0.2646	0.1043	0.0601	0.4690	6.43	0.0112
annoacc	5	1	0.4359	0.1010	0.2380	0.6338	18.64	<.0001

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
annoacc	6	1	0.5303	0.0995	0.3352	0.7254	28.38	<.0001
annoacc	7	1	0.5360	0.1003	0.3394	0.7325	28.56	<.0001
annoacc	8	1	0.6910	0.0980	0.4990	0.8830	49.77	<.0001
annoacc	9	1	0.7318	0.0980	0.5398	0.9238	55.81	<.0001
annoacc	10	1	0.8491	0.0968	0.6595	1.0387	77.02	<.0001
annoacc	11	1	0.7718	0.0995	0.5767	0.9668	60.16	<.0001
annoacc	12	1	0.7203	0.1040	0.5164	0.9242	47.93	<.0001
annoacc	13	1	0.7465	0.1230	0.5054	0.9876	36.83	<.0001
annoacc	0	0	0.0000	0.0000	0.0000	0.0000	.	.
annodiff	1	1	-0.0887	0.0415	-0.1701	-0.0074	4.58	0.0324
annodiff	2	1	-1.1171	0.0604	-1.2354	-0.9987	342.42	<.0001
annodiff	3	1	-1.7941	0.0840	-1.9588	-1.6294	455.86	<.0001
annodiff	4	1	-2.3215	0.1140	-2.5450	-2.0979	414.38	<.0001
annodiff	5	1	-2.3994	0.1270	-2.6484	-2.1505	356.89	<.0001
annodiff	6	1	-2.7240	0.1606	-3.0387	-2.4093	287.77	<.0001
annodiff	7	1	-2.2936	0.1422	-2.5723	-2.0149	260.13	<.0001
annodiff	8	1	-3.0068	0.2208	-3.4396	-2.5741	185.47	<.0001
annodiff	9	1	-3.2233	0.2746	-3.7615	-2.6852	137.81	<.0001
annodiff	10	1	-3.3294	0.3262	-3.9687	-2.6901	104.19	<.0001
annodiff	11	1	-3.6627	0.4449	-4.5347	-2.7907	67.78	<.0001
annodiff	12	1	-3.1271	0.4352	-3.9800	-2.2742	51.64	<.0001
annodiff	13	1	-2.3422	0.4381	-3.2008	-1.4836	28.59	<.0001
annodiff	0	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	430.3712	0.0000	430.3712	430.3712		

Note: The scale parameter was estimated by the square root of Pearson's Chi-Square/DOF.

LR Statistics For Type 3 Analysis						
Source	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq
annoacc	13	78	15.23	<.0001	198.00	<.0001
annodiff	13	78	205.48	<.0001	2671.22	<.0001

Modello di Poisson con Sovradispersione-Logaritmo per pagamenti rapportati a una misura di esposizione

- Variabili risposta: $Y_{ij} = \frac{P_{ij}}{w_i}$ pagamenti rapportati al numero di sinistri dell'anno i denunciati nell'anno di accadimento w_i, **Poisson con Sovradispersione**, con pesi i numeri di sinistri dell'anno i denunciati nell'anno di accadimento $\omega_i = w_i$;
- Variabili esplicative: i (annoacc) e j (annodiff), di classificazione $\eta_{ij} = \boldsymbol{x}'\beta = \mu + \alpha_i + \beta_j$;
- Funzione di collegamento: $g = log$.

```
proc genmod data = runoff1;
    class annoacc (ref = first) annodiff (ref = first);
    model pagamentinden = annoacc annodiff /
        dist = poisson
        link = log
        scale = pearson
        type3;
    weight nden;
run;
```

The GENMOD Procedure

Model Information		
Data Set	WORK.RUNOFF1	
Distribution	Poisson	
Link Function	Log	
Dependent Variable	pagamentinden	
Scale Weight Variable	nden	nden

Number of Observations Read	105

Number of Observations Used	105
Sum of Weights	3019776

Class Level Information		
Class	Levels	Values
annoacc	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0
annodiff	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	78	14260424.598	182825.9564
Scaled Deviance	78	76.9921	0.9871
Pearson Chi-Square	78	14447110.935	185219.3710
Scaled Pearson X2	78	78.0000	1.0000
Log Likelihood		16546.6067	
Full Log Likelihood		-16497154.04	
AIC (smaller is better)		32994362.072	
AICC (smaller is better)		32994381.708	
BIC (smaller is better)		32994433.729	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	5.7791	0.0818	5.6188	5.9395	4990.20	<.0001
annoacc	1	1	0.1776	0.1054	-0.0289	0.3841	2.84	0.0919
annoacc	2	1	0.3268	0.1027	0.1256	0.5280	10.14	0.0015
annoacc	3	1	0.2943	0.1057	0.0872	0.5014	7.76	0.0053
annoacc	4	1	0.3942	0.1043	0.1897	0.5986	14.28	0.0002
annoacc	5	1	0.5141	0.1010	0.3162	0.7120	25.92	<.0001
annoacc	6	1	0.5967	0.0995	0.4016	0.7918	35.94	<.0001
annoacc	7	1	0.6257	0.1003	0.4292	0.8223	38.93	<.0001
annoacc	8	1	1.0454	0.0980	0.8534	1.2374	113.90	<.0001
annoacc	9	1	1.0019	0.0980	0.8099	1.1939	104.60	<.0001
annoacc	10	1	1.2260	0.0968	1.0364	1.4156	160.57	<.0001
annoacc	11	1	1.2347	0.0995	1.0397	1.4297	153.98	<.0001
annoacc	12	1	1.3203	0.1040	1.1164	1.5242	161.06	<.0001
annoacc	13	1	1.3778	0.1230	1.1368	1.6189	125.47	<.0001
annoacc	0	0	0.0000	0.0000	0.0000	0.0000	.	.
annodiff	1	1	-0.0887	0.0415	-0.1701	-0.0074	4.58	0.0324
annodiff	2	1	-1.1171	0.0604	-1.2354	-0.9987	342.42	<.0001
annodiff	3	1	-1.7941	0.0840	-1.9588	-1.6294	455.86	<.0001
annodiff	4	1	-2.3215	0.1140	-2.5450	-2.0979	414.38	<.0001
annodiff	5	1	-2.3994	0.1270	-2.6484	-2.1505	356.89	<.0001
annodiff	6	1	-2.7240	0.1606	-3.0387	-2.4093	287.77	<.0001
annodiff	7	1	-2.2936	0.1422	-2.5723	-2.0149	260.13	<.0001
annodiff	8	1	-3.0068	0.2208	-3.4396	-2.5741	185.47	<.0001
annodiff	9	1	-3.2233	0.2746	-3.7615	-2.6852	137.81	<.0001
annodiff	10	1	-3.3294	0.3262	-3.9687	-2.6901	104.19	<.0001
annodiff	11	1	-3.6627	0.4449	-4.5347	-2.7907	67.78	<.0001
annodiff	12	1	-3.1271	0.4352	-3.9800	-2.2742	51.64	<.0001
annodiff	13	1	-2.3422	0.4381	-3.2008	-1.4836	28.59	<.0001
annodiff	0	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	430.3712	0.0000	430.3712	430.3712		

Note: The scale parameter was estimated by the square root of Pearson's Chi-Square/DOF.

LR Statistics For Type 3 Analysis

Source	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq

LR Statistics For Type 3 Analysis

Source	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq
annoacc	13	78	42.02	<.0001	546.21	<.0001
annodiff	13	78	205.48	<.0001	2671.22	<.0001

Modello di Poisson-Composto-Logaritmo per pagamenti rapportati a una misura di esposizione

- Variabili risposta: $Y_{ij} = \frac{P_{ij}}{w_i}$ pagamenti rapportati al numero di sinistri dell'anno i denunciati nell'anno di accadimento w_i, **Poisson-Composta**, con pesi i numeri di sinistri dell'anno i denunciati nell'anno di accadimento $\omega_i = w_i$;
- Variabili esplicative: i (annoacc) e j (annodiff), di classificazione $\eta_{ij} = \boldsymbol{x}'\beta = \mu + \alpha_i + \beta_j$;
- Funzione di collegamento: $g = log$.

```
proc genmod data = runoff1;
    class annoacc (ref = first) annodiff (ref = first);

    csi = 1.01887;
    y = _RESP_;
    mu = _MEAN_;

    variance var = mu*csi;

    if y = 0 then
        d = 2 * mu**(2 - csi) / (2 - csi);
    else
        d = -2 * (y * (mu**(1 - csi) - y**(1 - csi)) / (1 - csi) - (mu**(2 - csi) - y**(2 - csi)) / (2 - csi));

    deviance dev = d;

    model pagamentinden = annoacc annodiff /
        link = log
        scale = pearson
        type3;

    weight nden;
run;
```

The GENMOD Procedure

Model Information		
Data Set	WORK.RUNOFF1	
Distribution	User	
Link Function	Log	
Dependent Variable	pagamentinden	
Scale Weight Variable	nden	nden

Number of Observations Read	105
Number of Observations Used	105
Sum of Weights	3019776

Class Level Information		
Class	Levels	Values
annoacc	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0
annodiff	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	78	13163753.882	168766.0754
Scaled Deviance	78	72.4134	0.9284
Pearson Chi-Square	78	14179315.033	181786.0902
Scaled Pearson X2	78	78.0000	1.0000
Log Likelihood		-36.2067	
Full Log Likelihood		-36.2067	
AIC (smaller is better)		126.4134	
AICC (smaller is better)		146.0498	
BIC (smaller is better)		198.0704	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	5.7791	0.0818	5.6188	5.9395	4990.30	<.0001
annoacc	1	1	0.1776	0.1054	-0.0289	0.3841	2.84	0.0919
annoacc	2	1	0.3268	0.1027	0.1256	0.5280	10.14	0.0015
annoacc	3	1	0.2943	0.1057	0.0872	0.5014	7.76	0.0053
annoacc	4	1	0.3942	0.1043	0.1897	0.5986	14.28	0.0002
annoacc	5	1	0.5141	0.1010	0.3162	0.7120	25.92	<.0001
annoacc	6	1	0.5967	0.0995	0.4016	0.7918	35.94	<.0001
annoacc	7	1	0.6257	0.1003	0.4292	0.8223	38.94	<.0001
annoacc	8	1	1.0454	0.0980	0.8534	1.2374	113.91	<.0001
annoacc	9	1	1.0019	0.0980	0.8099	1.1939	104.60	<.0001
annoacc	10	1	1.2260	0.0968	1.0364	1.4156	160.57	<.0001
annoacc	11	1	1.2347	0.0995	1.0397	1.4297	153.99	<.0001
annoacc	12	1	1.3203	0.1040	1.1164	1.5242	161.06	<.0001
annoacc	13	1	1.3778	0.1230	1.1368	1.6189	125.47	<.0001
annoacc	0	0	0.0000	0.0000	0.0000	0.0000	.	.
annodiff	1	1	-0.0887	0.0415	-0.1701	-0.0074	4.58	0.0324
annodiff	2	1	-1.1171	0.0604	-1.2354	-0.9988	342.42	<.0001
annodiff	3	1	-1.7941	0.0840	-1.9588	-1.6294	455.86	<.0001
annodiff	4	1	-2.3215	0.1140	-2.5450	-2.0979	414.39	<.0001
annodiff	5	1	-2.3994	0.1270	-2.6483	-2.1505	356.89	<.0001
annodiff	6	1	-2.7240	0.1606	-3.0387	-2.4092	287.78	<.0001
annodiff	7	1	-2.2936	0.1422	-2.5723	-2.0149	260.13	<.0001
annodiff	8	1	-3.0068	0.2208	-3.4396	-2.5741	185.47	<.0001
annodiff	9	1	-3.2232	0.2746	-3.7614	-2.6851	137.81	<.0001
annodiff	10	1	-3.3292	0.3261	-3.9684	-2.6900	104.20	<.0001
annodiff	11	1	-3.6627	0.4449	-4.5347	-2.7907	67.78	<.0001
annodiff	12	1	-3.1271	0.4352	-3.9800	-2.2742	51.64	<.0001
annodiff	13	1	-2.3422	0.4381	-3.2008	-1.4836	28.59	<.0001
annodiff	0	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	426.3638	0.0000	426.3638	426.3638		

Note: The scale parameter was estimated by the square root of Pearson's Chi-Square/DOF.

LR Statistics For Type 3 Analysis						
Source	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq
annoacc	13	78	38.02	<.0001	494.31	<.0001
annodiff	13	78	189.80	<.0001	2467.38	<.0001

Modello di Poisson con Sovradispersione-Logaritmo per pagamenti rapportati a una misura di esposizione

- Variabili risposta: $Y_{ij} = \frac{P_{ij}}{w_i}$ pagamenti rapportati al numero di sinistri dell'anno i denunciati nell'anno di accadimento w_i, **Poisson con Sovradispersione**, con pesi i numeri di sinistri dell'anno i denunciati nell'anno di accadimento $\omega_i = w_i$;
- Variabili esplicative: i (annoacc), j (annodiff) e $i + j$ (annopag), di classificazione $\eta_{ij} = \boldsymbol{x}'\beta = \mu + \alpha_i + \beta_j + \gamma_{i+j}$;
- Funzione di collegamento: $g = log$.

```
proc genmod data = runoff1;
    class annoacc (ref = first) annodiff (ref = first) annopag;
    model pagamentinden = annoacc annodiff annopag /
        dist = poisson
        link = log
        scale = pearson
        type3;
    weight nden;
run;
```

The GENMOD Procedure

Model Information		
Data Set	WORK.RUNOFF1	
Distribution	Poisson	
Link Function	Log	
Dependent Variable	pagamentinden	
Scale Weight Variable	nden	nden

Number of Observations Read	105
Number of Observations Used	105
Sum of Weights	3019776

Class Level Information		
Class	Levels	Values
annoacc	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0
annodiff	14	1 2 3 4 5 6 7 8 9 10 11 12 13 0
annopag	14	0 1 2 3 4 5 6 7 8 9 10 11 12 13

Criteria For Assessing Goodness Of Fit			
Criterion	DF	Value	Value/DF
Deviance	66	10720784.463	162436.1282
Scaled Deviance	66	66.3551	1.0054
Pearson Chi-Square	66	10663412.571	161566.8571
Scaled Pearson X2	66	66.0000	1.0000
Log Likelihood		18979.8945	
Full Log Likelihood		-14727333.97	
AIC (smaller is better)		29454745.937	
AICC (smaller is better)		29454793.937	
BIC (smaller is better)		29454849.442	

Algorithm converged.

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept		1	4.8454	1.0388	2.8094	6.8815	21.76	<.0001
annoacc	1	1	0.2951	0.1395	0.0218	0.5685	4.48	0.0343
annoacc	2	1	0.5029	0.2050	0.1010	0.9048	6.02	0.0142
annoacc	3	1	0.4727	0.2792	-0.0746	1.0200	2.87	0.0905
annoacc	4	1	0.5844	0.3562	-0.1137	1.2825	2.69	0.1009
annoacc	5	1	0.7189	0.4352	-0.1340	1.5718	2.73	0.0985
annoacc	6	1	0.8375	0.5145	-0.1708	1.8459	2.65	0.1035
annoacc	7	1	0.9726	0.5971	-0.1978	2.1430	2.65	0.1034
annoacc	8	1	1.5515	0.6794	0.2199	2.8831	5.21	0.0224
annoacc	9	1	1.6365	0.7632	0.1407	3.1324	4.60	0.0320
annoacc	10	1	1.9659	0.8471	0.3057	3.6261	5.39	0.0203
annoacc	11	1	2.0614	0.9338	0.2312	3.8916	4.87	0.0273
annoacc	12	1	2.2159	1.0013	0.2534	4.1785	4.90	0.0269
annoacc	13	1	2.3115	1.0424	0.2686	4.3545	4.92	0.0266
annoacc	0	0	0.0000	0.0000	0.0000	0.0000	.	.
annodiff	1	1	-0.0107	0.0883	-0.1837	0.1623	0.01	0.9035
annodiff	2	1	-0.9643	0.1713	-1.3001	-0.6285	31.68	<.0001
annodiff	3	1	-1.5729	0.2573	-2.0773	-1.0686	37.36	<.0001
annodiff	4	1	-2.0294	0.3463	-2.7082	-1.3507	34.34	<.0001
annodiff	5	1	-2.0365	0.4297	-2.8788	-1.1943	22.46	<.0001
annodiff	6	1	-2.2839	0.5202	-3.3035	-1.2643	19.28	<.0001
annodiff	7	1	-1.7727	0.5968	-2.9425	-0.6029	8.82	0.0030
annodiff	8	1	-2.4041	0.6964	-3.7690	-1.0392	11.92	0.0006
annodiff	9	1	-2.5525	0.7921	-4.1050	-1.0000	10.38	0.0013
annodiff	10	1	-2.5925	0.8877	-4.3324	-0.8526	8.53	0.0035

Analysis Of Maximum Likelihood Parameter Estimates								
Parameter		DF	Estimate	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
annodiff	11	1	-2.8695	1.0014	-4.8321	-0.9069	8.21	0.0042
annodiff	12	1	-2.2588	1.0688	-4.3536	-0.1640	4.47	0.0346
annodiff	13	1	-1.4085	1.1139	-3.5916	0.7746	1.60	0.2060
annodiff	0	0	0.0000	0.0000	0.0000	0.0000	.	.
annopag	0	1	0.9687	1.0460	-1.0814	3.0189	0.86	0.3544
annopag	1	1	0.7962	0.9600	-1.0853	2.6777	0.69	0.4069
annopag	2	1	0.6252	0.8765	-1.0927	2.3431	0.51	0.4757
annopag	3	1	0.6656	0.7934	-0.8895	2.2207	0.70	0.4016
annopag	4	1	0.6738	0.7101	-0.7181	2.0656	0.90	0.3427
annopag	5	1	0.6838	0.6264	-0.5439	1.9114	1.19	0.2750
annopag	6	1	0.7182	0.5433	-0.3467	1.7831	1.75	0.1862
annopag	7	1	0.6952	0.4604	-0.2072	1.5976	2.28	0.1310
annopag	8	1	0.4907	0.3780	-0.2501	1.2315	1.69	0.1942
annopag	9	1	0.3391	0.2958	-0.2407	0.9190	1.31	0.2516
annopag	10	1	0.2005	0.2142	-0.2192	0.6203	0.88	0.3491
annopag	11	1	0.1177	0.1345	-0.1460	0.3813	0.77	0.3816
annopag	12	0	0.0000	0.0000	0.0000	0.0000	.	.
annopag	13	0	0.0000	0.0000	0.0000	0.0000	.	.
Scale		0	401.9538	0.0000	401.9538	401.9538		

Note: The scale parameter was estimated by the square root of Pearson's Chi-Square/DOF.

LR Statistics For Type 3 Analysis						
Source	Num DF	Den DF	F Value	Pr > F	Chi-Square	Pr > ChiSq
annoacc	12	66	3.79	0.0002	45.53	<.0001
annodiff	12	66	28.48	<.0001	341.81	<.0001
annopag	12	66	1.83	0.0617	21.91	0.0386