

4 Problem Gambling Counselling

Data on clients receiving Problem gambling counselling is kept in the Integrated Reports Information System (IRIS) database. From the database the following variables were computed:

Monthly Clients The number of unique clients having a Problem Gambling counselling service within a particular month.

Current Clients The number of unique clients who have had a Problem Gambling counselling service within the previous 12 months.

New Clients The number of unique clients who have had a Problem Gambling Counselling service within the month and whose last service, if there was one, was over twelve months ago.

Completely New Clients The number of unique clients who have had a Problem Gambling Counselling service within the month and who have not previously had a service.

Closed Clients The number of unique clients who were current at the end of the previous month but are not current at the end of the month in question.

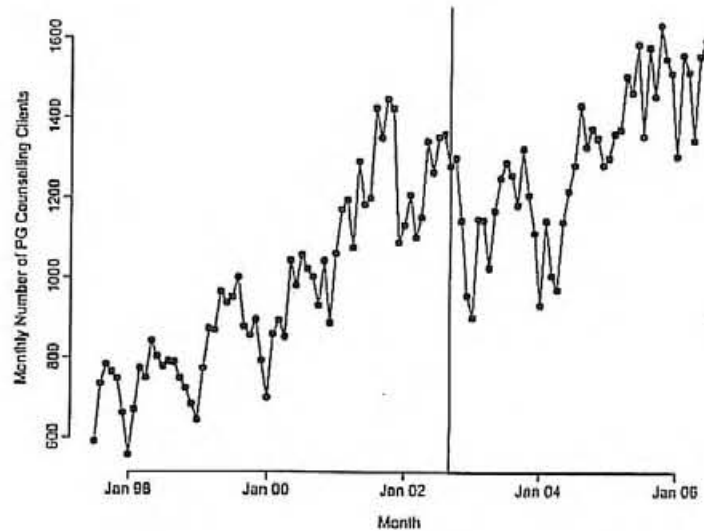
4.1 Monthly Problem Gambling Counselling Clients

A graph of the data are given in Figure 2 and the monthly numbers are given in Table 4. Although there appears to be a reduction in the monthly number of problem gambling clients, this might also be due to a trend that appears to have began about a year earlier.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997							591	734	782	763	747	661
1998	559	669	773	750	841	803	778	791	788	748	723	684
1999	645	773	872	869	964	938	951	1000	878	856	895	793
2000	701	859	893	853	1042	981	1055	1021	1002	932	1041	888
2001	1060	1171	1195	1076	1291	1184	1200	1425	1350	1447	1423	1089
2002	1131	1207	1102	1152	1342	1265	1352	1359	1279	1300	1143	956
2003	902	1146	1144	1025	1168	1250	1289	1257	1183	1324	1207	1112
2004	933	1143	1006	971	1141	1218	1283	1432	1330	1374	1351	1284
2005	1302	1362	1373	1505	1465	1586	1357	1578	1456	1634	1550	1514
2006	1307	1559	1516	1347	1557	1596						

Table 4: Monthly problem gambling counselling clients.

Figure 2: Time series plots for monthly problem gambling counselling clients.



Similar to the analysis of gambling expenditure, the first analysis conducted for the number of monthly problem gambling counselling clients was to fit a linear model to the log of the number of monthly clients with a linear trend, a step change for the impact of the smoking bans, a change in slope term, and dummy variables for the months. The results are given in Table 5.

The interpretation of the results in Table 5 is as follows:

- the intercept term corresponds to the log of the number of clients at the beginning of the data period.
- the trend term shows there is an increase of approximately 1.18% per month prior to the smoking bans, corresponding to an annual increase of 15.2%.
- the -0.24 coefficient means there was an approximate 24% decrease in expenditure corresponding to the smoking ban. A better approximation to the reduction is

$$100 \times (1 - \exp(-0.204)) = 21.3\%$$

with a 95% confidence interval ranging from 15.6% to 26.8%.

- Corresponding to the smoking bans there was also a decrease in the trend of about 0.33%

Table 5: Summary of fitted model for monthly number of problem gambling counselling clients.

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Call:
lm(formula = log(ds1) ~ trend + stepch + chtrend + DumFeb + DumMar +
    DumApr + DumMay + DumJun + DumJul + DumAug + DumSep + DumOct +
    DumNov + DumDec)

Residuals:
    Min       1Q   Median       3Q      Max
-0.188755 -0.050880 -0.004411  0.052956  0.152234

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  6.3188328  0.0334316 189.008 < 2e-16 ***
trend        0.0117847  0.0005872  20.068 < 2e-16 ***
stepch      -0.2405839  0.0325542  -7.390 6.23e-11 ***
chtrend     -0.0032562  0.0010858  -2.999 0.003477 **
DumFeb      0.1443666  0.0387795   3.723 0.000337 ***
DumMar      0.1433350  0.0387903   3.695 0.000371 ***
DumApr      0.0983696  0.0388082   2.535 0.012923 *
DumMay      0.2172665  0.0388333   5.595 2.21e-07 ***
DumJun      0.2022340  0.0388655   5.203 1.16e-06 ***
DumJul      0.1860357  0.0388170   4.793 6.22e-06 ***
DumAug      0.2490448  0.0388203   6.415 5.81e-09 ***
DumSep      0.2188702  0.0388333   5.636 1.85e-07 ***
DumOct      0.2276076  0.0388082   5.865 6.82e-08 ***
DumNov      0.1941992  0.0387903   5.006 2.62e-06 ***
DumDec      0.0660581  0.0387795   1.703 0.091827 .
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.08226 on 93 degrees of freedom
Multiple R-Squared:  0.9117, Adjusted R-squared:  0.8984
F-statistic: 68.6 on 14 and 93 DF,  p-value: < 2.2e-16

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per month. The estimated annual trend after the smoking bans is 10.4%.

- There is a seasonal pattern in the number of clients, with the lowest values in December, January and around Easter, and the highest values in August to October.

All the terms in the model are statistically significant. However, there is also some autocorrelation in the residuals, which means that the standard errors may be underestimated. Therefore a time series regression model was fitted, allowing for the autocorrelation between successive

Table 6: Summary of fitted model for monthly number of problem gambling counselling clients taking into account autocorrelations.

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Call:
arima(x = log(ds1), order = c(1, 0, 0), seasonal = list(order = c(1, 0, 0),
  frequency = 12), xreg = cbind(trend, stepch, chtrend))

Coefficients:
      ar1      sar1  intercept   trend   stepch  chtrend
 0.5677  0.4925    6.4971  0.0109  -0.1474  -0.0039
s.e.  0.0881  0.0891    0.0615  0.0016   0.0623   0.0030

sigma^2 estimated as 0.006349:  log likelihood = 118.11,  aic = -222.21

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observations, and also including an autoregressive seasonal pattern rather than using dummy variables for the months. The results are given in Table 6. This model gives similar results for the trend and change in trend, but the standard errors are more realistic, and in all cases larger. The annual trend prior to the smoking bans is estimated to be 14.0%, while after the smoking bans it is estimated to be 8.8%.

Importantly the estimate of the stepchange has decreased to be 13.7% with a 95% confidence interval ranging from 2.3% to 23.8%.

From an examination of the data the effects of the smoking ban could be delayed, that is take place over a number of months. A structural time series model was fitted to the data, allowing a delayed effect. The model is given by

$$y_t = a_t + b_t + s_t + \frac{\omega}{1 - \delta B} z_{1t} + \eta z_{2t} + \varepsilon_t$$

where a_t , b_t and s_t are level, trend, and seasonal terms, as before, and B is the "Backshift" operator with $By_t = y_{t-1}$. Note that

$$\frac{\omega}{1 - \delta B} z_{1t} = \omega [z_{1t} + \delta z_{1,t-1} + \delta^2 z_{1,t-2} + \dots]$$

Here, δ represents the delayed effect of the smoking ban. A value of $\delta = 0$ means that the effect is immediate, while values of $\delta \neq 0$ means that the effects are gradual with ω representing the effect in the first month, $\omega + \delta$ representing the effect by month two, $\omega + \delta + \delta^2$ representing

the effect by month three and the long term effect given by

$$\frac{\omega}{1 - \delta}$$

The model was rewritten as

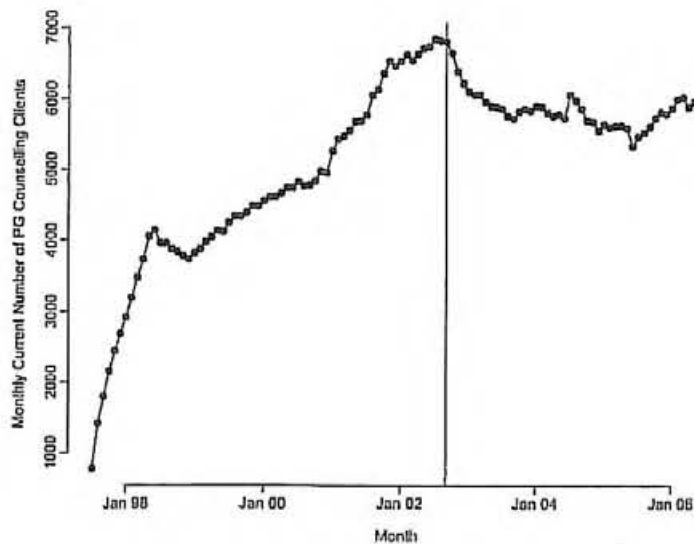
$$y_t - \delta y_{t-1} = a_t - \delta a_{t-1} + b_t - \delta b_{t-1} + s_t - \delta s_t + \omega z_{1t} + \eta(z_{2t} - \delta z_{2,t-1}) + \varepsilon_t - \delta \varepsilon_{t-1}$$

Nonlinear least squares was used to fit the model. It was found that the optimal value of ω was -0.055 , corresponding to a decrease in numbers in the first month of 5.5%, and the optimal value of δ was 0.32, implying a long term reduction of 8.1%. This figure is somewhat smaller than the 14% decrease using the ARIMA model, but is in the confidence interval.

4.2 Current Problem Gambling Clients

A plot of the number of current problem gambling clients is given in Figure 3 while a table of the number is given in Table 7. There is a marked change in the underlying trend corresponding to the introduction of the smoking bans.

Figure 3: Time series plots for current problem gambling counselling clients.



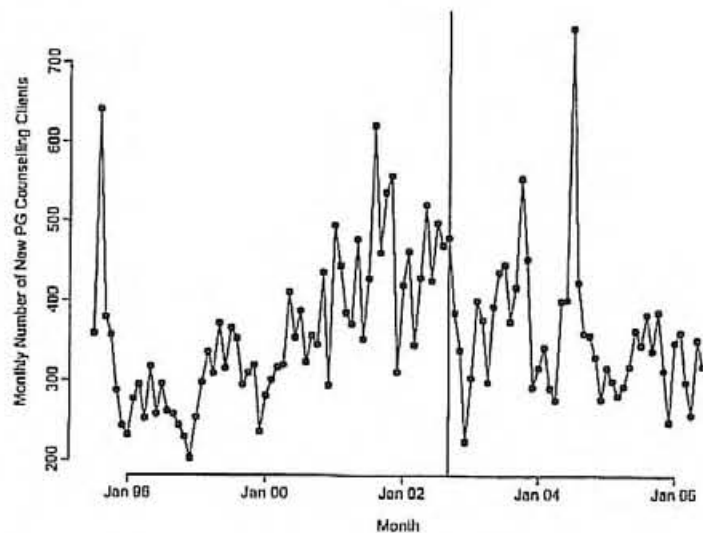
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997							775	1415	1794	2151	2438	2681
1998	2912	3188	3482	3734	4051	4136	3960	3955	3879	3838	3784	3737
1999	3818	3876	3974	4041	4126	4115	4244	4329	4330	4381	4475	4472
2000	4546	4599	4605	4655	4733	4735	4817	4760	4768	4830	4967	4946
2001	5248	5420	5465	5546	5667	5682	5766	6044	6125	6343	6520	6451
2002	6518	6608	6530	6618	6702	6725	6831	6809	6802	6631	6373	6208
2003	6097	6054	6056	5955	5895	5879	5857	5756	5715	5811	5853	5829
2004	5894	5882	5800	5754	5775	5723	6049	5974	5854	5687	5667	5547
2005	5631	5590	5609	5617	5577	5328	5460	5515	5599	5723	5803	5777
2006	5861	5988	6013	5877	5951	5820						

Table 7: Monthly current problem gambling counselling clients.

4.3 New Problem Gambling Clients

A plot of the number of new problem gambling clients is given in Figure 4 while a table of the data is given in Table 8.

Figure 4: Time series plots for new problem gambling counselling clients.



Similar analyses were conducted for the monthly number of new problem gambling clients.

The interpretation of the results in Table 9 is as follows:

- the intercept term corresponds to the log of the number of clients at the beginning of the data period.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997							359	640	379	357	287	243
1998	231	276	294	252	317	257	295	261	257	243	228	202
1999	253	297	335	309	371	315	365	352	294	309	318	235
2000	280	300	316	319	410	354	387	323	356	345	435	294
2001	494	443	385	371	476	352	427	620	460	536	557	311
2002	419	461	345	428	520	425	497	469	479	385	338	223
2003	303	400	376	298	393	435	445	375	417	554	452	292
2004	316	342	291	276	400	402	743	423	360	357	330	277
2005	316	300	281	293	318	363	345	383	338	386	313	248
2006	348	361	298	257	351	319						

Table 8: Monthly new problem gambling counselling clients.

- the trend term shows there is an increase of approximately 0.87% per month prior to the smoking bans, corresponding to an annual increase of 11.1%.
- the -0.14 coefficient means there was an approximate 14% decrease in expenditure corresponding to the smoking ban. A better approximation to the reduction is

$$100 \times (1 - \exp(-0.14)) = 13.4\%$$

with a 95% confidence interval ranging from 0.9% to 24.3%.

- Corresponding to the smoking bans there was also a decrease in the trend of about 1.2% per month. The estimated annual trend after the smoking bans is -4.9% .
- There is a seasonal pattern in the number of new clients, with the lowest values in December, January and around Easter, and the highest values after Easter and in July and August.

All the terms in the model are statistically significant. However, there is also some autocorrelation in the residuals, which means that the standard errors may be underestimated. Therefore a time series regression model was fitted, allowing for the autocorrelation between successive observations, and also including an autoregressive seasonal pattern rather than using dummy variables for the months. The results are given in Table 10. This model gives similar results for the trend and change in trend, but the standard errors are more realistic, and in all cases larger. The annual trend prior to the smoking bans is estimated to be 8.8%, while after the smoking bans it is estimated to be -4.8% .

Table 9: Summary of fitted model for monthly number of new problem gambling counselling clients.

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Call:
lm(formula = log(ds1) ~ trend + stepch + chtrend + DumFeb + DumMar +
    DumApr + DumMay + DumJun + DumJul + DumAug + DumSep + DumOct +
    DumNov + DumDec)

Residuals:
    Min       1Q   Median       3Q      Max
-0.30077 -0.11399 -0.01615  0.07996  0.70905

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  5.4958162  0.0693031  79.301 < 2e-16 ***
trend        0.0087002  0.0012173   7.147 1.97e-10 ***
stepch      -0.1441008  0.0674843  -2.135 0.03536 *
chtrend     -0.0128894  0.0022509  -5.726 1.25e-07 ***
DumFeb       0.0787391  0.0803892   0.979 0.32989
DumMar       0.0007432  0.0804115   0.009 0.99265
DumApr      -0.0509585  0.0804487  -0.633 0.52801
DumMay       0.1848021  0.0805007   2.296 0.02394 *
DumJun       0.0839904  0.0805675   1.042 0.29989
DumJul       0.2607934  0.0804669   3.241 0.00165 **
DumAug       0.2479028  0.0804738   3.081 0.00272 **
DumSep       0.1409823  0.0805007   1.751 0.08319 .
DumOct       0.1652898  0.0804487   2.055 0.04272 *
DumNov       0.0950978  0.0804115   1.183 0.23997
DumDec      -0.2217799  0.0803892  -2.759 0.00699 **
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1705 on 93 degrees of freedom
Multiple R-Squared:  0.5619, Adjusted R-squared:  0.496
F-statistic: 8.521 on 14 and 93 DF,  p-value: 1.617e-11

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Importantly the estimate of the stepchange has decreased to be 11.8% with a much wider 95% confidence interval ranging from 29.5% decrease to a 10.3% increase. Part of the reason for the wide confidence interval might be the unusual number of new clients in July 2004, as well as the apparent decreasing trend prior to the smoking bans.