P Spending by problem gamblers

The amount of spending accounted for by problem gamblers is relevant on several grounds. It provides:

- an insight into the financial consequences of gambling problems for problem gamblers and their immediate family;
- key data for examining the level of consumer surplus for problem gamblers from their consumption of gambling (chapter 5); and
- evidence on whether gambling providers are likely to have strong incentives to ameliorate problem gambling.

This appendix sets out the methodology for estimating the problem gambling expenditure shares and provides detailed data.

Section P.1 sets out some of the differing definitions of expenditure that are often used in gambling, while section P.2 describes aggregate spending on gambling in Australia and its distribution among consumers.

Section P.3 then calculates the share of expenditure derived from problem gamblers for individual gambling modes. It also tests whether these share estimates are significantly affected by problem gamblers who may spend something in a given mode, but whose real gambling problem lies elsewhere.

Section P.4 then calculates the average expenditure of problem gamblers and their overall share of the commercial gambling market. However, since the Commission's *National Gambling Survey* both over and underestimates some parts of the gambling market (like all other surveys of this kind), it is important to adjust the data for these biases. The adjusted data provide the best picture of expenditure by problem gamblers and a reader wishing to see the bottom line should look at tables P.6 and P.7.

Problem gamblers are a heterogenous group. Some have moderate problems only, while others have severe difficulties the resolution of which may require direct intervention. Section P.5 sets out the expenditure shares of these two sub-groups of problem gamblers and the methodology used to estimate them.

P.1 Definitions of spending

A variety of definitions are used to describe the amount of consumer spending on gambling. Each is useful, but they should not be confused with each other:

- *Outlays* are the amount of money that a gambler brings to a gambling venue (or takes from an ATM or borrows from someone) and uses to gamble during a gambling session. For example, if someone bets $50 on a race then this represents an outlay of $50. Similarly, the purchase of a $2 lottery ticket represents an outlay of $2. Outlays must always be positive.[1]
- *Turnover* is the sum of all stakes, including those derived from winnings during a gambling session. Turnover will typically be many times bigger than player losses, and is an inappropriate measure of the amount of money that consumers spend on gambling. Turnover is probably best seen as a quantity measure of gambling, in that the price of gambling (the average player loss rate) times turnover is equal to total expenditure measured as player losses.
- *Player losses* (also sometimes referred to as spend, net outlays or gross revenue to the gambling provider) is equal to the initial outlay, less any final winnings. It is also equal to turnover less cumulative wins. For example, if someone made bets equal to $300 at the races and won back $200, then the player losses are equal to $100. Player losses will obviously be negative for gamblers who win more than they lose in a gambling session. Overall, player losses is the most appropriate measure of expenditure — and conceptually matches measures of expenditure for other goods.

Table P.1 illustrates the three concepts for a person playing on a gaming machine.

[1] In some contexts, this facet of outlays makes it a more useful spending measure than actual losses. For example, say that there are 10 males and 10 females playing an identical game of pure chance and spending the same amount each. The spending shares based on outlays are equal. However, say that, by chance, enough males win so that player losses among this group are zero, while all of the females lose. The spending shares based on player losses would suggest that females accounted for 100 per cent of player losses. While that may be true in this hypothetical case, it is not the expected outcome and would be unlikely to occur again in repeated cases. The outlay share provides, in this instance, a more realistic view of player losses. In games of repeated play and high frequency low prize wins, such as gaming machines and scratchies, shares of player losses are the best measure. But for lotteries, in particular, outlay shares can sometimes be more appropriate.

Table P 1 **Outlays, player losses and turnover**[a]

An example based on a gaming machine

Sequence of button presses	*Amount of gambling funds*	*Staked*	*Turnover (cumulative stake)*	*Win*	*Cumulative win*	*Player losses (cumulative net position)*
	$	$	$	$	$	$
0	**60**	..	..	..	..	..
1	50	10	10	0	0	10
2	90	10	20	50	50	-30
3	80	10	30	0	50	-20
4	70	10	40	0	50	-10
5	80	10	50	20	70	-20
6	70	10	60	0	70	-10
7	80	10	70	20	90	-20
8	70	10	80	0	90	-10
9	60	10	90	0	90	0
10	50	10	**100**	0	**90**	**10**

a The outlay in this case is equal to $60, which is the amount that the gambler takes from her purse to gamble, and is equal to initial value of money that the gambler puts into the gaming machine. The turnover is equal to the cumulative amount staked (including recycled winnings), which in this case is equal to $100. The player losses are equal to the amount brought to gamble at the start ($60) less the amount left at the end ($50), which equals $10. Alternatively, the player losses can be seen as turnover less cumulative wins.

Source: Commission calculations.

P.2 Some stylised facts about gambling expenditure

Australians lost around $10.8 billion on commercial gambling in 1997-98, with foreign visitors losing around another $540 million (table P.2). With a population of around 14.1 million adults, that represents average expenditure per adult of around $760.

However, around 20 per cent of Australians did not participate in commercial gambling last year (although some of these participated in non-commercial gambling such as sweeps, raffles and private games). This implies that average losses per *gambler* are around $940 per year.

Even so, many gamblers spend very little on gambling, sometimes buying a lottery or scratch ticket, occasionally placing a bet on the races, going to a casino or trying their luck on the 'pokies'. The Commission's *National Gambling Survey* suggests that the median commercial gambling spend is around one third of the average, which indicates that there is a 'tail' of big spenders who have a significant influence on the recorded average (table P.3 and figure P.1). This is even more pronounced

for some gambling categories, such as gaming machines, wagering and casino table games.

Table P 2 **The Australian gambling market, 1987-98**

Gambling mode	*ABS 1997-98*	*Tasmanian Gaming Commission 1997-98*	*PC National Gambling Survey March 1998 - March 1999*	*Hybrid measure*
	$ million	$ million	$ million	$ million
Gaming machines	6400.8	5867.0[a]	3719.8	6400.8
Total wagering (excluding sportsbetting)	1600.2	1663.9[g]	901.4	1600.2
Total sportsbetting	23.4	24.5	50.6	23.4
Lotteries, lotto style and pools	1179.1	988.1	1679.7	1179.1
Scratchies	246.4	224.8	130.6	246.4
Keno				
Club keno	175.7	170.9[h]	..	175.7
Casino keno	33.4	..	..	33.4
Total keno	209.1	..	315.1	209.1
Casino table games				
Table games including foreigners	1431.6	2232.0[b]	..	1431.6
Foreign losses	536.5	..	..	536.5
By residents	895.1		747.2	895.1
Internet casino games	..	..	27.4	27.4[d]
Other commercial (bingo etc)	..	194.9[c]	189.3	189.3[e]
Private games	..	..	178.2	178.2
Commercial gambling involving Australian residents	10554.1	..	7761.1	**10770.8**[f]
Total gambling by Australian residents	..	..	7939.3	10949.0
Commercial gambling total	11090.6	11366.1[i]	..	**11090.6**

a This excludes gaming machines in casinos. **b** This includes gaming machines in casinos and casino keno. **c** This includes minor gaming forms such as bingo and some raffles. **d** This is included in the hybrid measure because the official statistics will have failed to pick up data on such internet gambling. **e** This is the preferred measure of 'other' for the hybrid measure because the Commission's *National Gambling Survey* did not include raffles. **f** This is the definitionally appropriate measure of gambling when calculating the magnitude of gambling expenditure by Australian residents. It excludes foreign gambling in casinos and private games and raffles. It is not perfect. It fails to subtract tourist spending on gambling outside of casinos (but this is believed to be small), and in the case of internet gaming and 'other' the hybrid measure combines data from April 1998 to April 1999 with other data for 1997-98. **g** This updates the published Tasmanian Gaming Commission data to take account of a slight underestimation of the expenditure through the Tasmanian TAB. **h** This updates the published Tasmanian Gaming Commission data to include club keno from Queensland. **i** This updates the total expenditure data published by the Tasmanian Gaming Commission (see notes g and h).

Sources: Australian Bureau of Statistics 1999, *1997-98, Gambling Industries, Australia*, Cat. no. 8684.0, June; Tasmanian Gaming Commission Database 1997-98 (including unpublished updates) and PC *National Gambling Survey*.

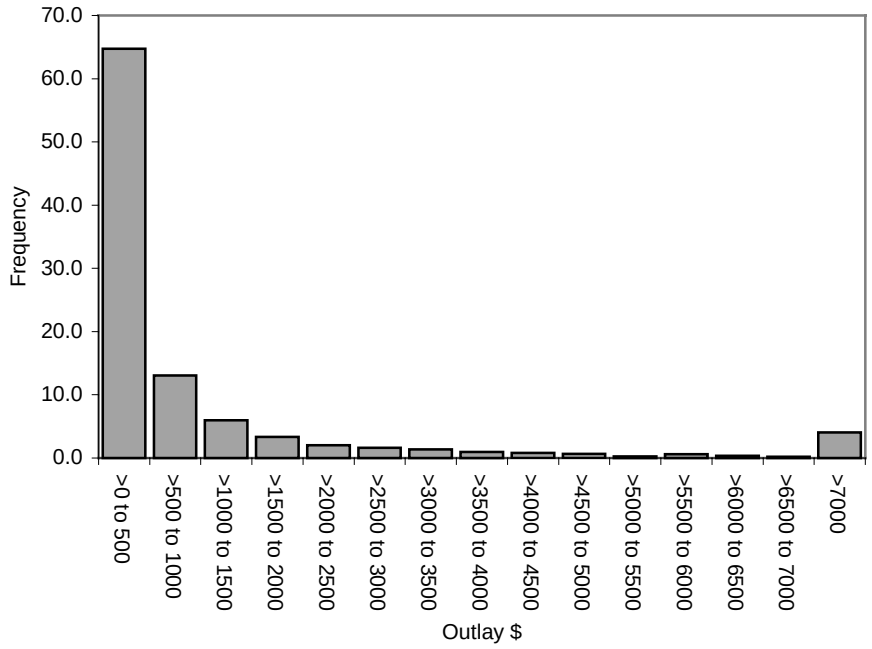
Table P 3 **Concentration of outlays on commercial gambling, Australia**[a]

Gambling type	*Top 10% of spenders share of aggregate outlay*	*Top 5% of spenders share of aggregate outlay*	*Ratio of median to mean*	*Mean outlay of the top 10% of spenders*
	%	%	ratio	$
Gaming machines	76.7	62.8	0.24	7 750
Wagering	82.1	64.6	0.16	10 011
Scratchies	56.3	41.7	0.33	409
Lotteries	39.0	33.1	0.63	1 498
Casino table games	78.7	64.8	0.13	12 532
All commercial gambling	72.9	59.4	0.33	10 377

a Based on outlays of gamblers, not player losses.

Source: PC *National Gambling Survey*.

Figure P 1 **Distribution of commercial gambling outlays**



a These data are outlays on commercial gambling (not player losses) from the PC *National Gambling Survey*, and exclude private games for money and raffles. These data have **not** been adjusted to take account of under enumeration of gambling expenditure.

Data source: PC *National Gambling Survey*.

One view is that gambling is like other consumer goods in showing such a pattern of concentrated consumer spending. Some data on US lotteries was provided to the Commission to support this and to infer that such a pattern would be similar for other gambling products. According to this view, the concept of problem gambling

— based on excessive expenditure — is questionable, when concentrated spending seems to be a recurrent pattern across many consumer goods.

However, lotteries (and to a lesser extent scratchies) show a quite different pattern to other gambling products. They exhibit some concentration of spending — as in all consumer goods — but nothing as extreme as that applying to other gambling forms. The top 10 per cent of spenders in Australian lotteries account for just under 40 per cent of total expenditure. In contrast, such a group accounts for around 80 per cent of total outlays for wagering, gaming machines and casino table games. Furthermore, the average annual outlay of heavy lottery players (the top 10 per cent) is about $1 500, which is not prohibitive as a share of most average incomes, whereas the average spends for the top 10 per cent of spenders in modes such as gaming machines ($7 750) and wagering ($10 011) looms much larger.[2] Accordingly, while expenditure concentration is characteristic of many consumer products, it appears to be more extreme and to involve large absolute amounts in some gambling forms.

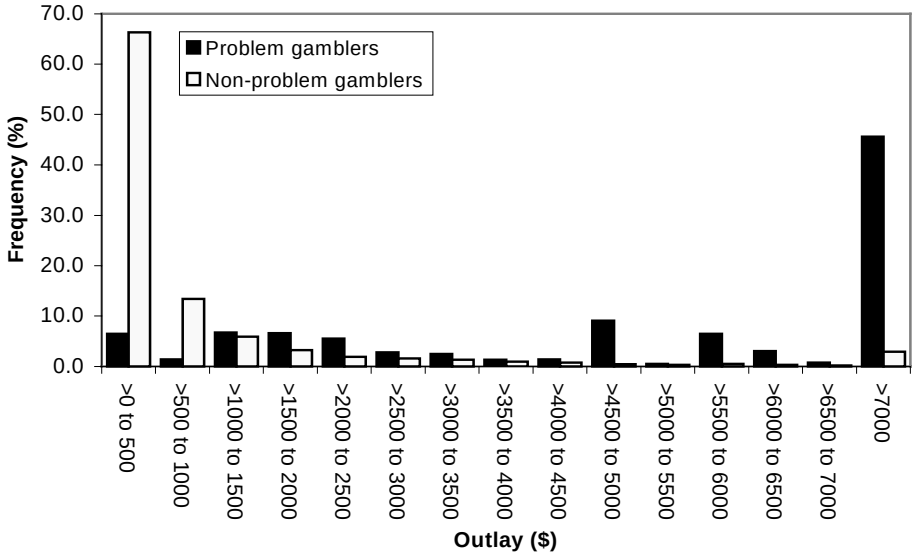
Problem gamblers, as diagnosed using the SOGS, are strongly represented among heavy gamblers (figure P.2), and people with higher SOGS scores tend to spend more on average than those with lower scores (figure P.3). Problem gamblers account for about 0.4 per cent of gamblers who outlay less than $500 a year on gambling, but for around 40 per cent of those who outlay more than $4 500 annually. Of course, this does not mean that heavy spending equates with excessive spending or with problem gambling — indeed it is still true that a majority of heavy gamblers are not problem gamblers (using the SOGS criterion of 5+).

P.3 Problem gambling expenditure by gambling mode

Using the methodology described in box P.1, the Commission calculated the expenditure levels and shares of problem gamblers in Australia by gambling mode (table P.4). Problem gamblers figure prominently in the overall expenditure of gaming machines, wagering and ‘other’ commercial gambling, but are much less significant for lotteries and casino table games.

[2] Although note that this is outlay, not player losses. Absolute values of player losses will tend to be smaller. On the other hand, these estimates have not been corrected for the sampling bias — all estimates would rise, bar lotteries, after such adjustment.

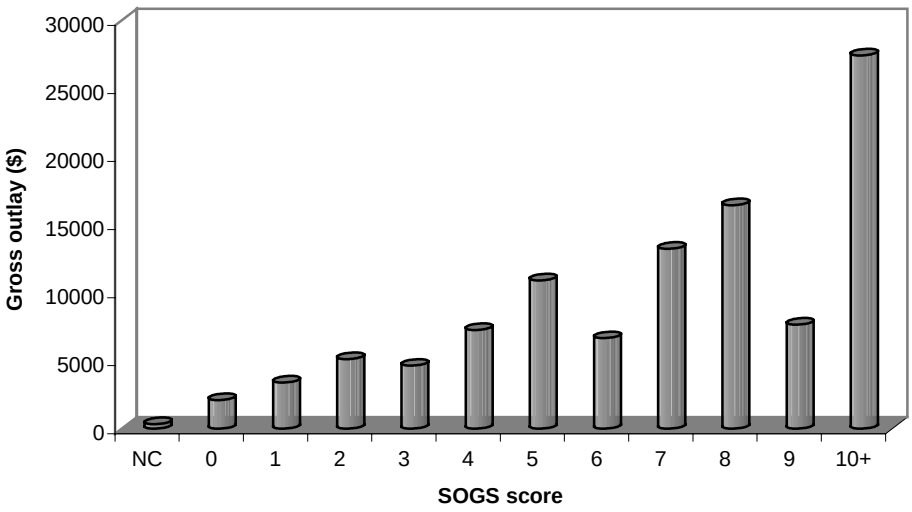
Figure P 2 **Distribution of outlay by problem and recreational gamblers**



aSee note for above figure.

Data source: PC *National Gambling Survey*.

Figure P 3 **Average annual outlays by SOGS score**



aThese data are not adjusted so that they are consistent with aggregate gambling expenditure data. That would tend to increase the average spending amount, but by a variable amount for each SOGS grouping depending on the areas where the people concerned were gambling (see section P.3). NC denotes the group of non-regular gamblers who were not asked the SOGS.

Data source: PC *National Gambling Survey*.

Box P 1 **Calculating the problem gambling expenditure share**

The Commission sought to examine the share of expenditure accounted for by problem gamblers (α) in Australia by calculating:

$$\alpha = \sum_{i=1}^{N} w_i E_i P_i / \sum_{i=1}^{N} w_i E_i \qquad \{1\}$$

where w_i is the weight associated with the ith observation, E_i is the expenditure measure (typically losses) for the ith person on gambling and P_i is an indicator variable which is equal to 1 for problem gamblers and 0 otherwise.

Equation {1} above can be re-written in a way that provides further insight into patterns of expenditure by problem gamblers. As noted by Volberg, Moore, Lamar, Christiansen, Cummings and Banks (1998, p. 354), another way of defining α is as:

$$\alpha = \frac{PREV \times PLF}{PREV \times PLF + (1 - PREV)} \qquad \{2\}$$

where PREV is the prevalence rate of problem gambling and PLF is the Proportional Loss Factor (equal to the ratio of losses made by problem gamblers to those made by non-problem gamblers). This expression reveals that a high value for α is obtained if PREV or/and PLF is high. For example, if the prevalence rate of problem gamblers among a group of people who gamble is 2 per cent, and problem gamblers spend 10 times more per year on average than non-problem gamblers, then this implies an expenditure share by problem gamblers of just under 17 per cent. Since the most clearly distinguishable feature of problem gambling is high expenditures on gambling, equation {2} is suggestive immediately that problem gambling shares of expenditure are likely to be appreciable.

Adjusting for the source of problem gambling

Data from people seeking help from counselling services (chapter 17) reveals that some forms of gambling, particularly gaming machines and wagering, appear to pose higher levels of risk for problem playing. Once it is recognised that a problem gambler's problems may stem from just one form of gambling, it raises the question of whether all other forms they may play should be tarred with the same brush. After all, consider someone who feels they have impaired control over their gaming machine play and spends $100 a week. They also play bingo once a week with friends, spending only $5 each time — rather less than the average. In one sense it seems legitimate to include the expenditure on bingo as part of this problem gambler's expenditure on gambling. However, if it is in no way a source of their problem it is not clear why this expenditure should be treated differently to any other form of expenditure, such as money spent on a movie or a meal.

Table P 4 **Expenditure shares of problem gamblers by mode**[a]
Australia 1999

	Outlay			*Player loss*		
	PLF mean	PLF median	Expenditure share (mean-based)	PLF mean	PLF median	Expenditure share (mean-based)
	Ratio	Ratio	%	Ratio	Ratio	%
Gaming machines	10.6	21.8	34.5	14.5	39.0	42.3
Wagering	6.8	9.1	23.6	10.8	10.0	33.1
Scratchies	3.1	2.3	8.5	8.0	2.2	19.1
Lotteries	1.7	1.3	4.5	2.1	1.4	5.7
Casino table games	1.6	4.0	9.9	1.7	8.0	10.7
Other (non-raffle)[b]	4.2	2.3	21.1	5.3	2.5	25.0

a PLF is the proportional loss factor — the ratio of expenditure by problem gamblers in any mode to that of non-problem gamblers.

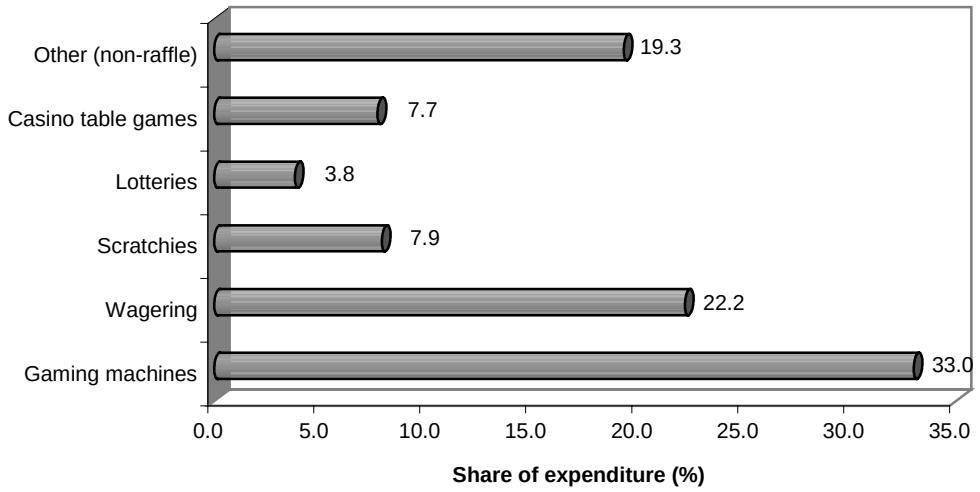
b This includes keno, bingo, sports betting, internet games, and other, but excludes private games for money and raffles. Of these gambling types, keno contributed most to the relatively high expenditure share of problem gamblers in this gambling mode.

A number of possible adjustments to the data are possible, albeit all being somewhat arbitrary:

- the favourite form of gambling for the problem gambler is sometimes regarded as the source of the problem. Expenditure shares could then be calculated for the favourite form only. The conceptual difficulty with this is that a favourite game may not always be the source of the problem. More critically, a player may experience problems with a number of gambling modes;
- the gambling form on which most is spent. While this is likely to be a source of a gambling problem, it also fails to deal with people who experience problems with multiple forms of gambling; and
- another possible adjustment could be based on the ratio of problem player to non-problem player losses (the PLF). If the PLF is relatively high (say two standard errors higher than the mean PLF) then that gambling form could be seen as problematic.[3] The results (figure P.4) suggest that much the same pattern emerges as apparent in table P.4. This suggests that taking smaller spending problem gamblers in any given mode out of the calculations makes very little difference to the overall contribution by problem gamblers to expenditure.

[3] A possible difficulty with this is that a problem gambler might spend small amounts on any individual gambling mode, but participate in so many that the collective expenditure constitutes a problem. Or it could be that a gambling mode is a problem for a person, even though the PLF is close to unity, because the expenditure is high relative to personal income.

Figure P 4 **Problem gambling share of outlays by gambling mode — adjusted for low spending problem gamblers**
Australia 1999



a For each problem gambler and for every gambling form, the expenditure was tested to see if it was two standard errors above the mean spending for that mode. If it was, then it was counted as spending by a problem gambler. If it was not, it was regarded as non-problem gambling spending. Figures are lower than the unadjusted data because problem gamblers who spent under two standard deviations from the mean will have their expenditure excluded.

Data source: PC *National Gambling Survey*.

P.4 Estimating the overall share of expenditure accounted for by problem gamblers

The Commission's survey (using unadjusted data) suggested that problem gamblers lose around 15 times as much, on average, as non-problem gamblers (table P.5).[4] If the median (the middle number) is used as the measure of central tendency, instead of the mean, then the ratio of spending is even greater, at around 20 times.

A revealing feature of the data is that the ratio of player losses to outlay is higher for problem gamblers than for non-problem gamblers. This is consistent with problem gamblers recycling their winnings more often than non-problem gamblers.

The overall implication of these data is that problem gamblers account for about 29 per cent of total gambling losses. However, if the PC *National Gambling Survey*

4 The existence of false positives (people who are wrongly categorised as problem gamblers) and false negatives (people who are wrongly categorised as non-problem gamblers) is likely to lead to an underestimate of the relative spending of these two groups.

is adjusted for biases in its estimates of overall gambling in each of the major gambling modes a different picture emerges, as we examine below.

Table P 5 **Annual expenditure by problem gamblers – unadjusted figures**[a]

	Outlays	*Player losses*
Average per year		
Problem gamblers ($)	11 620	7 631
Non-problem gamblers ($)	1 155	505
All gamblers ($)	1 424	689
Median per year		
Problem gamblers ($)	7 280	3 941
Non-problem gamblers ($)	414	199
All gamblers ($)	469	218
Proportional loss factors [b]		
PLF mean	10.1	15.1
PLF median	17.6	19.8
Share of expenditure (%)	21	28.6

a The data are from the PC *National Gambling Survey* and are unadjusted for the under-enumeration of total gambling. **b** The ratio of expenditure by problem gamblers to those of non-problem gamblers.

Source: PC *National Gambling Survey*.

Some qualifications and adjustments

The results above are based on a survey of the general population. The aggregate expenditures predicted by such surveys are often biased measures of the actual expenditures recorded by governments (based on tax data). The ABS *Household Expenditure Survey* underestimates spending by about 70 per cent.[5] Delfabbro (1998, p. 183) finds that the South Australian survey data on poker machine expenditure is roughly half of that recorded by the gambling industry and the government. Other Australian gambling surveys also tend to underestimate losses.[6] The Productivity Commission's *National Gambling Survey* also underestimates spending, by about 25 per cent (table P.2).

Furthermore, the degree of bias in the Commission's survey varies by the type of gambling mode. For example, the Commission's survey suggested that total lottery spending in Australia was about 40 per cent higher than the official data

5 The Maribyrnong City Council (sub. D181, pp. 16-25) provides a very extensive and useful analysis of the darwbacks of the HES.

6 The problem is not isolated to Australia. The recent US national survey found that Americans *won* a net US $2 billion from casino tables and poker machines, when they in fact *lost* around US $20 billion net (Gerstein et al. 1999 pp. 31–32). A similar story was apparent for wagering;[6] Americans also spent around US $3.3 billion on lotteries, about one fifth of the actual aggregate spending (which is about US $15 billion).

(table P.2)[7], while under-enumerating spending on gaming machines and wagering. The fact that the bias in expenditure estimates varies by gambling mode has an important implication for trying to estimate the overall share of expenditure accounted for by problem gamblers. In some gambling modes, problem gamblers account for a significant share of expenditure, while in others, much less so. If the Commission's survey has under-enumerated spending in those gambling modes where problem gamblers make a small (large) contribution to spending in that mode, then the aggregate share of spending by problem gamblers will be overestimated (underestimated).

To derive an adjusted aggregate share of gambling expenditure (table P.6) the Commission combined:

- the problem gambling shares of player losses from the PC *National Gambling Survey* for each of the relevant gambling modes (from table P.4);
- with the shares of each mode in aggregate Australian resident commercial gambling derived from table P.2.

Table P 6 **Problem gambling player losses per year**

Adjusted for expenditure biases, 1997-98

Gambling form	*Value $ million*	*Share of gambling mode in total*[a]	*Problem gambling share of player losses*[b]	*Unadjusted problem gambling expenditure*	*Adjusted problem gambling expenditure*
	$ million	%	%	$ million	$ million
Gaming machines	6 400.8	59.4	42.3	1 575.0	2 707.5
Wagering	1 600.2	14.9	33.1	298.1	529.7
Scratchies	246.4	2.3	19.1	25.0	47.1
Lotteries	1 179.1	10.9	5.7	96.5	67.2
Casino table games	895.1	8.3	10.7	79.9	95.8
Other commercial	449.2	4.2	25.0	145.4	112.3
Total	**10 770.8**	**100.0**	**33.0**	**2 219.9**	**3 559.6**

a The adjusted problem gambling spending share (s) is derived as:

$$s = \sum_{i=1}^{6} \left(\frac{E_i}{\sum_{i=1}^{6} E_i} \times \frac{PG_i}{E_i^*} \right)$$

where E_i is the spending from the aggregate data (the 'hybrid' data in table P.2), PG_i is the problem gambling spending in mode i from the PC *National Gambling Survey* and E_i^* is the total spending in mode i from the PC *National Gambling Survey*.

Source: Table P.2 and PC *National Gambling Survey*.

[7] This is not a surprising result. Australian lotteries provide a significant share of the prize to just one winning combination. It would be rare for a survey to find such a winner and, accordingly, reported player losses will tend to be higher than actual losses.

ACIL (sub. D233. p. 48) claimed that the Commission had (inappropriately) used different scale-up factors for problem gamblers than non-problem gamblers when taking account of the biases in spending categories from the survey.[8] This represents a misunderstanding of the method used. Problem gamblers were treated no differently to other gamblers in making the adjustment. In each gambling mode the Commission assumed that total spending for any gambler is biased by some *constant* factor. In some expenditure categories, for example, lotteries and other commercial gambling, the Commission's aggregate estimates of spending were higher than official statistics. After adjustment for expenditure biases, the estimate of absolute spending accounted for by problem gamblers *fell* in these cases. However, because the Commission's data under-enumerated spending in gaming machines and wagering significantly, the absolute amount of expenditure accounted for by problem gamblers increased overall. On the basis of these adjustments, **the Commission estimates that problem gamblers account for one third of total gambling losses by Australians.**

The implication of the adjusted data is that a problem gambler spends around $12 200 per year compared to about $650 for a non-problem gambler — or around 16 times as much (table P.7).

Table P 7 **Annual average player losses by mode**

Adjusted for expenditure biases

Gambling mode	*Mean losses by problem gamblers*	*Mean losses by non-problem gamblers*	*Overall losses*
	$	$	$
Gaming machines	10 674	711	1 174
Wagering	3 727	325	466
Scratchies	256	31	38
Lotteries	295	135	139
Casino table games	1 099	584	615
Other commercial	628	107	135
Total	12 237	645	938

a These estimates are obtained by dividing the estimated problem gambling player losses in table P.6 by the estimated number of problem gamblers given by the Commission's prevalence estimates.

Source: PC *National Gambling Survey* and table P.6.

8 The expert testimony attached to the ACIL submission made a number of other comments regarding methodologies for estimating spending, and especially warned against using the median as a basis for estimating overall expenditure. The Commission agrees that medians would be an inappropriate basis for calculating the total expenditure, and did not base any estimates of overall gambling expenditure on medians (in either the final or draft report).

It should be emphasised that the estimated expenditure share of problem gamblers could be somewhat higher or lower than one third, and that the number should be seen as indicative rather than an exact measure:

- In each gambling mode, the survey estimates of expenditure diverge somewhat from the official statistics (though not as badly as most other surveys of this kind). We have assumed that the degree of over or understatement is the same for problem and non-problem gamblers.
  - However, if problem gamblers understate their spending by more than others, then the figures in the tables above would show an even greater concentration of player losses among problem gamblers — with corresponding greater financial impacts on the affected individuals and their families. This could be the case if, for example, problem gamblers, do not want to acknowledge their losses, out of embarrassment or other motivations. This is consistent with some of the underlying behaviour that characterises problem gambling (such as concealing evidence of gambling).
  - On the other hand, if recreational gamblers understate their spending by a proportionately greater amount, then the above estimate of the problem gambling spending share would be biased upwards. For example, as ACIL noted (sub. D233, p. 48), recreational gamblers may tend to forget small losses, which are relatively minor compared to everyday expenses and more likely to be remote in time, whereas problem gamblers may be more aware of the large amounts that they spend regularly. However, according to the Commission's *National Gambling Survey*, regular non-problem-gambler heavier spenders account for a significant share of total spending. If it is argued that high spending and regularity are likely to lead to more accurate recollection of gambling losses, then this group should not have substantially biased spending. That means that the missing money would have to be largely accounted for by notionally light spenders, but the adjustment of their mean losses needed to account for the major part of the understatement would be implausibly large. It seems likely that all groups have some difficulty in trying to assess or divulge their spending accurately, and without concrete evidence there is no basis assuming the level of understatement is higher or lower for problem gamblers compared to other groups of gamblers.
- The data are derived from a survey, and inevitably, sampling and non-sampling errors may affect the reliability and accuracy of the data.

The fact that player perceptions of expenditure vary so significantly from the real amounts lost should be subject to further research to see if improvements in survey or other data collection methods provide more accurate answers.

P.5 Estimating the expenditure share of moderate versus severe problem gamblers

The Commission has emphasised that, just as gambling products are heterogeneous, so are problem gamblers. From a public health angle there is interest in people who do not need treatment, but who nevertheless exhibit some of the behaviours and problems of those who do (as in obesity, diabetes and a range of orthodox public health concerns). This group is termed moderate problem gamblers (or what Shaffer et al. term type level 2 problem gamblers). It is useful to know the spending share of this group relative to the severe, 'need treatment', group for the analysis of the consumer surplus in chapter 5.

Unfortunately, there are a number of difficulties in trying to estimate the relative spending shares of these two groups of problem gamblers. The Commission has used Dickerson's definition of severe problem gambling, which involves a weighted sum of gamblers across the different SOGS scores. For example, Dickerson assumes that one in five people with a score of 5 on the SOGS is a severe problem gambler. This raises the difficulty of determining which of the SOGS 5 gamblers will be counted as severe and which as moderate for the purpose of allocating expenditure to each of these problem gambling categories:

One method would be to assume that mean expenditure in each SOGS category is equal between the two groups, but that is contrary to evidence that those who need treatment tend to spend more than those who do not.

Another method would be to presume that the severe problem gamblers always spend more than any moderate problem gambler in any SOGS score category. That, however, ignores the fact that many heavy gamblers do not face big problems.

The Commission adopted another approach. In any given SOGS score category and for each gambling mode, the population of gamblers are sorted by their HARM scores, starting with those who scored the highest. The Dickerson quota (for example, 20 per cent in the case of SOGS 5) is allocated to the those with the highest HARM scores, until the quota is depleted. All gamblers classified as severe problem gamblers using this method had at least a score of one on the HARM criterion. Inevitably, it is rare that the data provides the expenditure share for exactly the Dickerson quota — that is achieved through interpolation. While being complex to implement, the advantage of this method is that at least it uses a criterion of harm to try to identify the severe cases within each SOGS category.

This method produces expenditure shares for severe and moderate problem gamblers in each gambling mode. As before these are then weighted by the official

data to derive an overall estimate of the shares of commercial gambling accounted for by the two groups of problem gamblers (table P.8).

Table P 8 **Shares of player losses by severe and moderate problem gamblers**

Gambling type	*Severe share*	*Moderate share*	*Problem gambling share*
	%	%	%
Gaming machines	33.7	8.7	42.3
Wagering	23.5	9.5	33.1
Scratchies	7.8	11.3	19.1
Lotteries	2.1	3.7	5.7
Casino table games	2.5	8.2	10.7
Other commercial	16.5	8.5	25.0
Total	24.8	8.3	33.0

Source: PC *National Gambling Survey* and table P.6.

Interestingly, the data suggests that severe gamblers account for the bulk of expenditure by problem gamblers in gaming machines and wagering. They account for rather less in the remaining gambling forms, where the evidence from both the prevalence and treatment data suggest gambling problems are much less extreme.

P.6 Standard errors

The Commission's survey uses a complex design, with a two phase selection process for asking expenditure and SOGS questions. This means that conventional standard errors will tend to suggest a higher level of precision than is actually the case. In order to provide an estimate of the standard errors corrected for the complex design, the Commission used a re-sampling approach (the 'bootstrap'). This involves using a computer to draw many repeated samples from a 'master' data set, replicating all the features of the complex survey design in each replication. Then the outcomes from the replications provide an idea of the extent to which the design and sampling variability affect the precision of the estimates.

The Commission undertook a simulation, with 5 000 replications, to examine the expenditure shares of each of the major gambling modes as above. For each replication, a weighted average of the expenditure shares across the modes was calculated, using the weights from table P.6. These weighted averages were then sorted in ascending order. The 125^{th} observation in the list of values then represents the estimate of the lower 2.5% tail of the 95 per cent confidence interval. Other values from the list represent other significance cutoff points. The confidence intervals for each of the gambling modes and for the weighted average of gambling

expenditures shares are shown in table P.9. These data suggest that our inference that problem gamblers account for an economically significant share of overall gambling expenditure is not affected by the sampling and design effects in our survey.[9]

Results for individual gambling modes are less reliable, particularly where the survey has relatively small samples for those playing that mode (such as table games), or where there is considerable variability in player amounts (such as race betting). For example, the 95 per cent confidence interval for the share of expenditure accounted for by problem gamblers in race betting is from 10 per cent to 64 per cent, while it is 2.1 per cent to 23.3 per cent for table games. On the other hand, the confidence interval for gaming machines is relatively narrow.

Table P 9 **Confidence intervals on shares of player losses by problem gamblers by mode**

Bootstrap estimates[a]

Threshold	*Gaming machines*	*Wagering*	*Scratchies*	*Lottery*	*Table games*	*Other*	*Total*
	%	%	%	%	%	%	%
2.5% lower tail	32.6	9.8	4.9	1.0	2.1	12.1	25.2
5% lower tail	34.1	13.4	6.6	1.8	3.2	13.8	26.7
10% lower tail	36.0	17.0	8.7	2.6	4.5	15.9	28.0
10% upper tail	48.5	49.8	30.8	8.9	17.8	34.5	38.1
5% upper tail	50.3	56.3	35.1	10.1	20.5	37.1	39.5
2.5% upper tail	51.8	63.6	39.6	11.5	23.3	39.6	40.8
Mean	42.3	33.1	19.1	5.7	10.7	25.0	33.0

a Based on 5 000 replications. The estimate for the confidence intervals for total gambling expenditure is based on calculating the weighted average of the expenditure shares and then sorting these from low to high, and selecting the values corresponding to the appropriate confidence thresholds. The confidence intervals for each of the other modes are calculated with a separate sort for each mode.

Source: Commission estimates and PC *National Gambling Survey*.

9 Although these calculations cannot take account of any other effects, such as non-response error and other non-sampling errors.