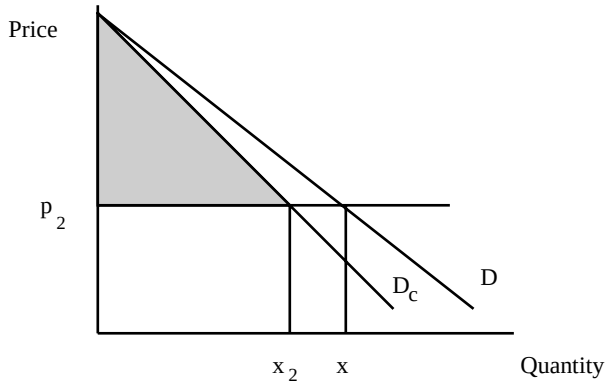
C Estimating consumer surplus

C.1 What is consumer surplus?

The consumer surplus from the purchase of any quantity of a product is the difference in dollars between the amount which the consumer pays for this product and the maximum amount which the consumer would be prepared to pay rather than do entirely without the product.

For a group of consumers, this can be understood by observing that at a given price a certain quantity of a product will be sold in the market. If the price falls, more of the product is sold, and both the original and new consumers who purchase at the new lower price are better off. The original consumers, who had been willing to pay the higher price, have gained a consumer surplus on their original purchases equivalent to the difference between the old and new prices. In other words, consumer surplus occurs when consumers pay less for a good or service than they are willing to pay for that good or service. The gain, in terms of consumer surplus, from the introduction of a new product is illustrated in figure C.1 below.

Figure C.1 **Consumer surplus**



The consumer surplus resulting from the introduction of a new product can be represented by the area underneath the demand schedule (or demand curve) for that

product in excess of the price paid. The demand schedule *D* in figure C.1 represents the quantity that consumers are willing to purchase at different prices. As the price rises, less is purchased, but the remaining buyers value the product at that higher price.

In theory, consumers would be willing to pay all the area under the demand schedule in excess of the market price and would still purchase the product. Indeed, some businesses sell essentially the same product at different prices to different customers (for example, movie theatres sell tickets at varying discounts) in an attempt to capture consumer surplus.

The demand curve *D* measures the price–quantity tradeoff for the new product or service in a situation where the consumer does not need to actually pay the consumer surplus. This is the demand curve that would typically be observed or estimated using information on prices and quantities of goods and services purchased over time.

The slope of the demand schedule (which is derived from information on the own price elasticity of demand for the product) is critical to the size of the consumer surplus. A product with a very flat demand schedule (a high price elasticity or elastic demand) will, other things being equal, have a lower consumer surplus than a product with a very steep demand schedule (lower price elasticity or inelastic demand). A product will have a high price elasticity when, for example, there are many substitutes for that product and if the price were to rise consumers would readily switch to other products.

Requiring consumers to pay the consumer surplus would, however, reduce consumers' income, thus reducing the amount actually purchased. A slightly steeper 'compensated demand schedule' (*Dc*) can be drawn representing the impact on income that actual payment of the consumer surplus would have. The more 'trivial' the product is in the consumers budget and/or the lower the income elasticity, the closer will the compensated demand schedule be to the uncompensated demand schedule.

The consumers' surplus in each case equals the area under the compensated demand schedule *Dc* above the relevant price level. The shaded area in figure C.1 thus shows the size of the consumers' surplus when the price of the new commodity equals p_2.

Bohm (1987) commented:

> We now know which area under what curve defines the exact size of the consumer's surplus. The next step is to note that the Dc curve is often close enough to the D curve

> for the area under the latter curve - the ordinary demand curve - to give a reasonably good approximation of the consumer's surplus.

Similarly, Mishan (1971, p. 338) commented that:

> Goods having zero income effect are hard to come by, but for a great many purposes the income effect involved is small enough for economists to make use of the area under the demand curve as a close approximation of the relevant benefit or loss.

A number of economists have presented ways of estimating the difference between the observed demand schedule and the compensated demand schedule (Willig 1976, Hausman 1981).

Because the budget share of gambling for some gamblers — particularly problem gamblers — is high, the compensated demand schedule is potentially significantly different from the observed demand schedule. As a result, the Commission has used the relationship presented by Willig (1976) to estimate the surplus from the compensated demand schedule for gambling in its estimates of consumer surplus contained in this appendix.

Adding consumer surpluses

When the price of a particular product falls, or when a new product is introduced, a consumer surplus is generated as consumers purchase the same amount at a lower price or as consumers switch to the new product. A reasonable question to ask is whether there is any loss in consumer surplus elsewhere as a result of the shift in consumption to the new product. Is there a decline in consumer surplus in those products where the consumer is consuming less? The answer, according to the economic literature, is no (Mishan 1971).

The demand schedule for an individual product represents the net position in relation to the consumers' choice between various products. It represents how much of other products they are willing give up to purchase the new one. It represents the judgement that the benefit generated by the new product is greater than that of the old. If there were somehow any remaining loss resulting from switching away from other products, consumers would not be prepared to pay as much to make the shift. The elasticity of demand for the new product would be greater (that is, they would purchase less at any given price), and the consumer surplus of the new product would be correspondingly lower. Essentially, the consumer surplus for the new product is a measure of the net gain for the consumer, and already implicitly includes the 'losses' resulting from consuming less of the alternative.

C.2 Consumer surplus in the gambling industries

Legalising gambling is equivalent to the introduction of a new good or service. Once the price has been set (in a competitive market this would be determined by the costs of production), the area under the (compensated) demand schedule above that price is the consumer surplus resulting from the introduction of the new product. Consumers have received this benefit by shifting consumption to gambling and away from less preferred goods and services.

The key information needed to estimate consumer surplus in the gambling industry comprises:

- estimates of the price and income elasticities of the demand for gambling;
- the significance of gambling expenditure in consumers' total spending (budget shares); and
- information on current consumption of gambling — quantity and price.

Estimates of price elasticities

There is a paucity of up-to-date estimates of the price elasticity of gambling, and Australian estimates are even more scarce. There are a number of reasons for this, notably the difficulty of making an accurate measure from the data available. In Australia, as in other countries, access to gambling has been heavily restricted. The large changes in the quantity of gambling products purchased have been driven primarily by changes in regulations rather than changes in price. Changes in market shares between different forms of gambling are largely a result of the sequencing of the deregulation process, rather than changes in the relative prices of gambling products offered. In Australia, the decline in the average price of gambling that has been associated with the rapid rise in consumption is a result of the sequencing of liberalisation, with high priced forms of gambling such as lotteries being introduced before lower priced forms such as gaming machines and casinos.

The Commission has come across a range of elasticity estimates in the literature, which are presented in table C.1.

Table C.1 **Elasticities of demand for different types of gambling**

Author	*Period*	*Area*	*Preferred price elasticity*
Horse racing			
Suits (1979)	1949-71	24 US states	-1.36 to -1.82
Suits (1979)	1974	Nevada	-1.64
Gruen (1976)	1940-69	New York City	-1.57
Morgan and Vasche (1979)	1958-78	California	-1.48
Berl (1997)		New Zealand	-0.7
Bookmakers			
Suits (1979)	1974-75	Nevada	-1.64
Sports betting			
Suits (1979)	1974-75	Nevada	-2.17
Lotteries			
Clotfelter and Cook (1990)			-2.55 (lotto)
Clotfelter and Cook (1990)			-3.05 (numbers game)
Farrel and Walker,	1998, 1997	UK	-1.55 to -2.6
Berl, (1997) (Lotto and Instant Kiwi)		New Zealand	-1.054
Access Economics (1998)			
Tattslotto - low turnover		Australia	-2.19
Tattslotto - high turnover		Australia	-0.24
Ozlotto		Australia	-0.2 to -0.8
Powerball		Australia	-0.03 to -0.2
Other			
Swan (1992)			
All gambling		NSW	-1.6
Poker machines		NSW	-1.7
Casino		NSW	-1.9
Berl (1997) (EGMs and casino)		New Zealand	-0.8

While there is some variability in the estimates of the price elasticity of gambling, most studies indicate that the demand for gambling is quite sensitive to changes in price. The Commission, nevertheless, finds it difficult to believe that they provide an accurate picture of the price sensitivity of demand for gambling. The main reasons for suggesting that the literature overstates the price sensitivity of demand for gambling are:

- price (the odds of winning) is difficult for gamblers to observe, particularly for low probability games such as lotteries;
- there seems to be little substitution between various forms of gambling, indicating that consumers do not have abundant alternatives if prices rise; and
- gambling has been significantly deregulated over the last two decades, both in Australia and in other countries. It is difficult to disentangle the effects of price changes, which are typically falling as availability and competition increases,

from increased consumption resulting from increased accessibility and growing community acceptance of gambling as a legitimate form of entertainment.

In its modelling for Aristocrat (sub. 111), the CIE used a range of elasticity measures (-0.3, -1 and -1.7) but chose to present results based on an elasticity of -1. The CIE (p. 24) said:

> While a consensus estimate from these studies seems to be around -1.7 for gambling as a whole, a difficulty in utilising estimates from these studies is that in a number of cases the studies are fairly old (the studies quoted in Haig and Reece date back to the 1940's).
>
> We adopt a more conservative approach in this modelling allowing the elasticity of demand for gambling to take on different values. We conduct simulations assuming a price elasticity of demand (in absolute terms) of 0.3, 1 and 1.7. The measure of 0.3 is in line with what might be regarded as reasonable price elasticity estimates for other heavily taxed products such as tobacco. The value of 1.7 is based upon the estimates from the studies presented in table 3.1. The value of unity is simply a mid range estimate and is the basis for the results presented below.

Similarly, ACIL (Sub. 155), in modelling undertaken on behalf of a group of major gambling providers, used an own price demand elasticity for gambling products of -⅓.

Despite widespread reservations about estimates of high price sensitivity in the gambling industries, they may not be as unreasonable as first appear. Gambling is undertaken widely in the community. The vast majority of consumers spend modest amounts, treating gambling as a recreational activity. The majority of expenditure (some two thirds) comes from this group of recreational gamblers, for whom gambling is just one of a number of alternative forms of entertainment. Such consumers may well be quite sensitive to the price of gambling because of these alternatives, and it may be the response of this group to price changes that we are seeing when we observe high price elasticities.

It is, however, reasonable to presume that problem gamblers are less sensitive to changes in the price of gambling products, but the literature in this field does not attempt to distinguish between problem and recreational gamblers.

As a consequence of these uncertainties, the Commission has used a range of price elasticities for the demand for gambling — from -0.3 to -1.3. The components of this are discussed in more detail later in the appendix.

Estimates of income elasticity

Estimates of income elasticity are even more scarce than estimates of price elasticities (table C.2).

Table C.2 **Estimates of income elasticity from the literature**

Study	*Demand*	*Elasticity estimate*
Haig and Reece (1985)	Horse racing in the U.S.	0.6 to 1.0
Mason et al (1989)	Las Vegas gambling	0.3 to 0.8
Swan (1992)	Gambling in NSW	1.2

In the modelling work undertaken for the Commission in this inquiry (ECONTECH 1999), an income elasticity of 0.79 was used. The Commission has used this income elasticity in the estimates of consumer surplus contained in this appendix.

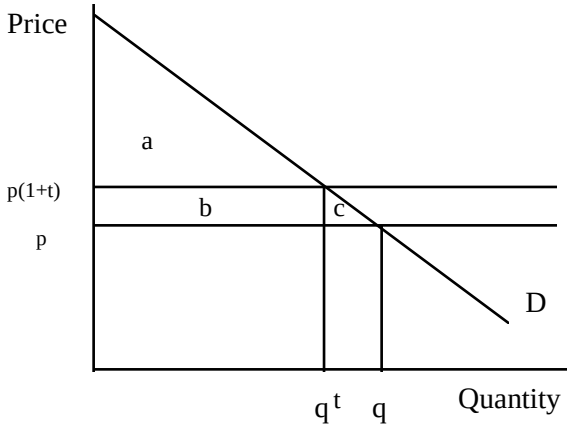
Accounting for high taxation

The level of taxation on gambling is very high. This varies significantly from product to product, but out of the $11 billion that consumers spent on gambling in 1997-98, over one third ($3.8 billion) went to government (equivalent to an average tax rate of 51 per cent). In the Commission's estimates of consumer benefit, the estimated annual equivalent of licence fees paid by the industry ($233 million) and the community contribution of clubs ($246 million) out of their gaming machine revenues have also been included. The total of taxes, licences and community contributions is estimated to be $4.3 billion in 1997-98.

When estimating the benefit from a new product, the question of the level of taxation needs to be considered. Taxation transfers part of the available consumer surplus to the government. There is also an efficiency loss to the community in the form of a small component of potential consumer surplus forgone as a result of the reduction in demand caused by the introduction of the tax. Chapter 18 discusses the loss (marginal excess burdens) associated with the range of taxes on gambling products in Australia.

This is illustrated in figure C.2, where p represents the price without tax, at which price q would be the quantity of the product consumed. The surplus generated would be the areas $a+b+c$. With the imposition of a tax increasing the price to $p(1+t)$, the quantity demanded falls to q^t. At q^t, the consumer surplus remaining for consumers is the area a, while the area b is transferred to government in the form of tax revenue. The area c of consumer surplus is lost as demand falls.

Figure C.2 **Tax and consumer surplus**



The consumer surplus is measured by looking at consumers' expenditure and information on their price elasticity, and would be represented by the area *a* in figure C.2. To measure the total level of benefit we must include tax revenue — that component of consumer surplus that is transferred to government. In the absence of the taxes, the price faced by consumers would be *p*, and the total consumer surplus they would enjoy would be the area $a+b+c$.

Accounting for problem gambling

Unlike most other forms of entertainment, gambling can have adverse effects for a small minority. While the number may be small, their contribution to total spending on gambling is much higher, and the cost to them and those close to them, can be severe. This cost also extends to the wider community as it attempts (through the health and welfare system) to assist those harmed by gambling. As a result of its national survey, the Commission has estimated that 2.1 per cent of the adult population are problem gamblers (those who score 5 or more on the SOGS), and these gamblers account for around one-third of the money spent on gambling each year.

How do we value consumer surplus for problem gamblers?

In most cases, we assume that consumers gain a benefit equal to the amount of money that they spend on the product or service, and gain the net benefit of the consumer surplus involved. Does this assumption hold when it comes to the spending of problem gamblers? If problem gamblers are treated in the same way as other consumers, their consumer surplus would be large. This is because they each spend, on average, some 20 times more than recreational gamblers, and because their demand is expected to be less sensitive to changes in price. In most cases, this

insensitivity to price changes is a signal that consumers value the product highly, and thus a high consumer surplus is generated. But in the case of problem gamblers, it could be argued that this insensitivity to price changes is the result of an inability to control consumption rather than the result of a high value placed on the product. Many, if not most problem gamblers, say that they would not gamble at all or would gamble considerably less if they could control their compulsion. As problem gamblers account for around one third of the money spent on gambling in Australia, these questions can have a major effect on estimates of the benefits of the gambling industries.

How should demand by problem and recreational gamblers be treated?

The demand schedule for any product or service is a composite of the demand schedules of individual consumers. For gambling, the two major groups of consumers that are of interest in this analysis are non-problem or recreational gamblers and problem gamblers. In the analysis in this appendix, each group is treated separately, and problem gamblers are further disaggregated into moderate problem gamblers and severe problem gamblers (appendix P). The key differences between the two groups are assumptions about their responsiveness to changes in the price of gambling, and assumptions about the nature of the benefit received by problem gamblers.

As noted, it is reasonable to presume that the demand of problem gamblers is less sensitive to price changes than is the demand of recreational gamblers.

In making estimates of consumer surplus and the benefits from gambling, two elasticity scenarios were used, a low elasticity scenario and a high elasticity scenario. The elasticities chosen should not be treated as precise estimates. They are, however, a reasonable indication of the likely demand by gamblers based on the Commission's judgement of the market for gambling products. The following price elasticities of demand for gambling products by the identified groups of consumers have been used (table C.3).

Table C.3 **Price elasticities of demand for gambling used in the Commission's estimates of benefits**

	Low demand elasticity	*High demand elasticity*
Recreational gamblers	-0.8	-1.3
Moderate problem gamblers	-0.6	-1
Severe problem gamblers	-0.3	-1

As mentioned earlier, the use of these elasticities, particularly those for problem gamblers would generate a high level of consumer surplus. But, many problem gamblers express a wish to discontinue gambling or at least control it to a much greater extent than they are currently able to do. Many other studies of the costs of gambling assume that problem gamblers receive no benefit from their gambling, that is, that all the money spent represents a cost for which there is no matching benefit and, by implication, no consumer surplus. The Commission considers that this assumption is too extreme. It is reasonable to presume that problem gamblers do gain some benefit from their expenditure, but the question is the likely level of that benefit.

There are two ways of looking at this issue. The first is to consider the level of consumption that problem gamblers are likely to undertake were they to be 'cured' of their obsessive gambling behaviour. Information from problem gamblers in treatment indicates that some 80 per cent seek to cease gambling altogether, with the remainder seeking to control their gambling expenditure at a much lower level (chapter 6). The second way of looking at this issue is to consider the likely expenditure by problem gamblers were they not to develop their compulsive gambling habit. This is likely to be a higher overall level of expenditure than that which would result from 'cured' problem gamblers. As problem gamblers typically start out as more intensive players than the average recreational gambler, it is reasonable to consider a pre-problem level of play similar to that of regular recreational gamblers.

While we can only speculate on the level of demand that problem gamblers would exhibit in the absence of the compulsion, there is sufficient information available to presume that it would be considerably less than their current level — as mentioned earlier, those who successfully 'kick the habit' typically spend nothing or very little on gambling, and even regular recreational gamblers are spending considerable less than the average problem gambler.

In estimating consumer surplus for problem gamblers in the absence of the compulsion, the Commission has assumed that they would spend an amount similar to that spent by regular recreational gamblers. This is estimated to be some $1500 each per year compared to their 1997-98 average spend of $12 200 each (box C.3

for an explanation of how the alternative level of spending was derived). Recreational gamblers are estimated to spend only $645 each in a year.

This results in an estimated annual expenditure by all problem gamblers of $438 million, less than 15 per cent of their current spending of $3.6 billion.

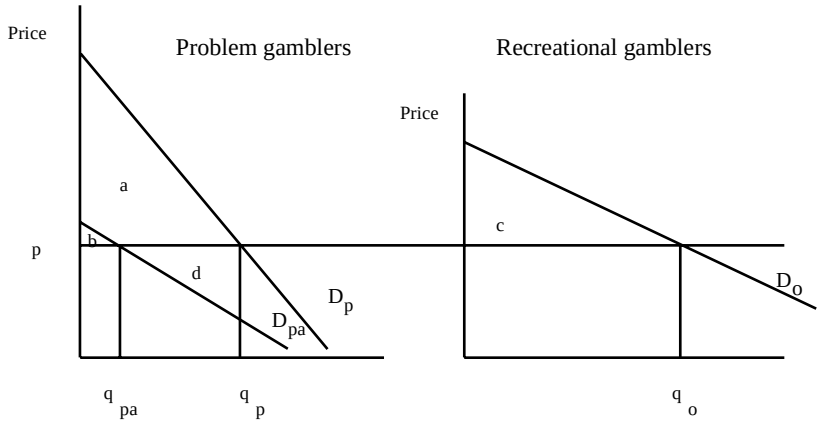
The demand condition for problem and recreational gamblers is illustrated in figure C.3. Two demand schedules are drawn for problem gamblers. The first is their observed demand (D_p), representing current consumption and the assumption that their demand is less sensitive to price changes than that of recreational gamblers. Their demand schedule in the absence of their compulsion is depicted as *Dpa*, representing the assumption that problem gamblers would consume considerably less in the absence of their compulsion.

For problem gamblers in the absence of the compulsion, there is an element of consumer surplus indicated by area *b*, where the value they receive is more than the price. As the quantity of gambling they would undertake in the absence of the compulsion is small (typically problem gamblers spend almost 20 times the amount per annum as recreational gamblers and 5 times the amount per annum than regular recreational gamblers), this surplus is likely to be small.

Importantly, spending in excess of the 'recreational' level is not all 'lost' to the problem gambler. It does have some value, even if this value is less than the amount of money paid. The value is represented by the area under the demand schedule in excess of the 'recreational' level of consumption. The loss that they face is represented by the area *d*. This area can be seen as representing 'negative' consumer surplus in that the real benefit (represented by D_{pa} in the absence of the compulsion) is less than the price they are paying. This may exceed the amount of 'true' consumer surplus (area *b*) that they derive from the activity.

For recreational gamblers, their consumer surplus is indicated by the area *c*.

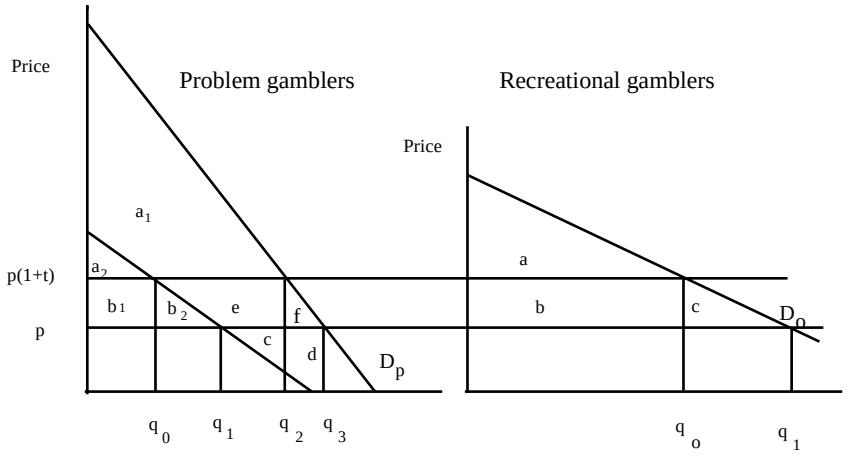
Figure C.3 **Consumer surplus for problem and recreational gamblers**



Accounting for tax and problem gamblers

The impact of taxation for problem and recreational gamblers is explored in more detail in figure C.4. For recreational gamblers, the situation is the same as that described in figure C.2, with the benefit being estimated as the areas *a* and *b*, being respectively the surplus retained by consumers and the tax transfer to government.

Figure C.4 **Consumer surplus and tax: problem and recreational gamblers**



For problem gamblers, the calculation is more complex. As developed previously, problem gamblers are seen as having two relevant demand schedules. The first (D_p) representing their observed demand, and a second 'non-compulsive' demand schedule representing their assumed demand if they did not gamble compulsively. In the absence of tax, 'observed' demand would be q_3 while their non-problem level of demand would be q_1. A surplus of $a_2+b_1+b_2$ would accrue to the consumer, to be offset against the 'negative' surplus of the areas $c+d$.

With the imposition of tax, the price increases to $p(1+t)$, actual consumption contracts to q_2. while consumption by recreational gamblers would fall to q_0. A problem gambler accrues a surplus of area a_2, while the government receives tax revenue b_1+b_2+e from problem gamblers. But area e represents a payment to government for which the gambler does not receive matching satisfaction and thus this area represents a loss to the gambler. The net gain in the tax collected is only the areas b_1 and b_2. The area c represents payments to the industry for which the gambler does not receive a matching level of benefit, and is thus a cost to the gambler.

While the area c goes to the industry, it pays for productive resources used to provide the product and thus it is not a net gain for the industry. However, the consumer is not getting a matching benefit from the money spent equivalent to the area c which thus represents a true loss to society. By comparison the area e represents a similar cost to the gambler but, because productive resources are not involved with the tax collected (ignoring for the moment the cost of running the tax system), others in society receive a benefit equivalent to the loss for the gambler, and thus the area e is neither a benefit nor cost for society, simply a transfer.

The net position is represented by benefits from areas a_2, b_1 and b_2, offset by the loss of area c.

Box C.1 **Problem gamblers: each area of the diagrams explained**

(a_2) Surplus on the assumed 'recreational' (non-compulsive) level of spending by problem gamblers. This area is a benefit to the consumer as it represents consumption on which consumers place a higher value than the cost they pay.

(b_1+b_2+e) Tax paid to government. As (for simplicity) we assume that there are no costs associated with government collecting the tax, this area represents a net benefit to government. It, however, represents a cost to the consumer but, in most cases, the consumer receives satisfaction equivalent to that cost and thus it usually does not represent a net cost to the consumer. In such situations, the revenue to government would represent a benefit overall. For problem gamblers the area is divided into two components outlined below.

(b_1+b_2) That part of the tax for which consumers receive a benefit in the form of satisfaction, as it lies under the 'recreational' (non-compulsive) demand schedule which measures the satisfaction that consumers are assumed to receive. While the consumer pays the money to government this cost is offset by this satisfaction. To the extent that the revenue to government is not offset by collection costs, this part of the total tax represents a benefit overall.

(continued)

Box C.1 **continued**

(e) That part of the tax for which consumers do not receive matching benefit. This area represents a loss to the consumer but this loss is offset by the gain to government. Thus, overall the area represents a transfer between groups and is neither a loss or benefit overall.

(c) That part of the consumers' payment to industry for the purchase of the product for which consumers do not receive a matching benefit. For the consumer this area is a loss. The payment to industry covers the cost of production and thus it is not a benefit for that group. Thus this area represents a loss overall.

C.3 The Commission's estimates

The Commission has used the depiction of demand by problem and recreational gamblers outlined above to arrive at a range of estimates of the benefits from the introduction of gambling. The following sections of this appendix outline in more detail the key data used (table C.4) and calculations undertaken by the Commission to estimate the benefits presented in chapter 5.

Table C.4 **Key data used**

		Wagering	*Lotteries*	*Scratchies*	*Gaming machines*	*Casino games*	*Other*	*All gambling*
Share of total spending by Australians accounted for by:								
MPGs	%	9.5	3.7	11.3	8.7	8.2	8.5	8.3
SPGs	%	23.5	2.1	7.8	33.7	2.5	16.5	24.8
All PGs	%	33.1	5.7	19.1	42.3	10.7	25.0	33.0
Total expenditure	$m	1 600.2	1 179.1	246.4	6 400.8	1 431.6	449.2	11 307.3
NPGs	$m	1 071.1	1 111.4	199.2	3 690.7	799.4	337.0	7 208.9
MPGs	$m	152.4	43.4	28.0	554.1	73.3	38.2	889.4
SPGs	$m	376.7	24.3	19.2	2 156.0	22.4	74.0	2 672.6
All PGs	$m	529.1	67.7	47.2	2 710.1	95.7	112.2	3 562.0
foreign	$m	0	0	0	0	563.5	0	563.5

Note: MPG = moderate problem gamblers, SPG = severe problem gamblers; PG = problem gamblers; NPG, non-problem (recreational) gamblers. **a** Gamblers and problem gamblers engage in more than one mode of gambling thus the number of gamblers in each mode cannot be added to arrive at the total number. **b** Per head spend in individual modes is low because gamblers and problem gamblers spend in modes other than those which account for the bulk of their expenditure. **c** estimated from ABS household disposable income divided by the adult population.

Source: PC National Gambling Survey, Tasmanian Gaming Commission, and Commission estimates.

Table C.4 **continued**

		Wagering	*Lotteries*	*Scratchies*	*Gaming machines*	*Casino games*	*Other*	*All gambling*
Tax	$m	610.9	832.1	173.5	2 365.0	279.9	50.8	4 312.2
NPGs	$m	408.9	784.3	140.3	1 363.6	170.3	38.1	2 826.4
MPGs	$m	58.2	30.6	19.7	204.7	15.6	4.3	348.7
SPGs	$m	143.8	17.1	13.5	796.6	4.8	8.4	1 047.8
All PGs	$m	202.0	47.8	33.2	1 001.3	20.4	12.7	1 396.5
foreign	$m	0	0	0	0	89.3	0	89.3
Price		0.14	0.40	0.38	0.10	0.11	0.33	0.16
Price elasticity (high)								
NPGs		-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3
MPGs		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
SPGs		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Price elasticity (low)								
NPGs		-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
MPGs		-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
SPGs		-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
Income elasticity		0.79	0.79	0.79	0.79	0.79	0.79	0.79
Number of NPGs[a]	'000	3 279.7	8 235.8	6 342.2	5 196.6	1 366.6	3 134.8	11 185.6
Number of MPGs[a]	'000	84.5	133.3	105.3	141.5	53.1	105.6	163.4
Number of SPGs[a]	'000	68.5	99.2	79.3	112.9	36.1	80.5	129.3
Total PGs[a]	'000	152.9	232.6	184.6	254.4	89.2	186.1	292.7
Spend per head[b]								
NPGs	$	327	135	31	710	585	108	644
MPGs	$	1805	325	266	3915	1382	362	5443
SPGs	$	5502	245	242	19,104	619	919	20 662
All PGs	$	-	-	-	-	-	-	12 168
Disposable income (1997-98) per head[c]	$	25 095	25 095	25 095	25 095	25 095	25 095	25 095
Gambling budget share								
NPGs	%	1.30	0.54	0.13	2.83	2.33	0.43	2.57
MPGs	%	7.19	1.30	1.06	15.60	5.51	1.44	21.69
SPGs	%	21.92	0.98	0.96	76.12	2.47	3.66	82.33
All PGs	%	13.79	1.16	1.02	42.45	4.28	2.40	48.49

Note: MPG = moderate problem gamblers, SPG = severe problem gamblers; PG = problem gamblers; NPG, non-problem (recreational) gamblers. **a** Gamblers and problem gamblers engage in more than one mode of gambling thus the number of gamblers in each mode cannot be added to arrive at the total number. **b** Per head spend in individual modes is low because gamblers and problem gamblers spend in modes other than those which account for the bulk of their expenditure. **c** estimated from ABS household disposable income divided by the adult population.

Source: PC National Gambling Survey, Tasmanian Gaming Commission (1999), and Commission estimates.

Table C.4 **continued**

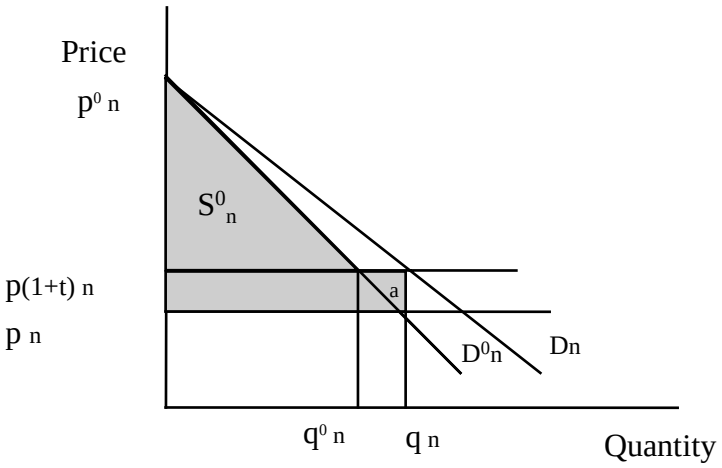
		Wagering	*Lotteries*	*Scratchies*	*Gaming machines*	*Casino games*	*Other*	*All gambling*
MPG 'recreational spend'	$m	38	12	4	155	27	10	244
SPG 'recreational spend	$m	31	9	3	124	19	8	194
Tax on 'recreational' spend								
MPGs	$m	13.4	8.1	3.1	47.8	4.5	1.1	85.0
SPGs	$m	10.9	6.1	2.3	38.1	3.1	0.8	67.3
PG 'recreational' budget share	%	1.78	0.34	0.17	4.37	2.04	0.37	5.96

Note: MPG = moderate problem gamblers, SPG = severe problem gamblers; PG = problem gamblers; NPG, non-problem (recreational) gamblers. **a** Gamblers and problem gamblers engage in more than one mode of gambling thus the number of gamblers in each mode cannot be added to arrive at the total number. **b** Per head spend in individual modes is low because gamblers and problem gamblers spend in modes other than those which account for the bulk of their expenditure. **c** estimated from ABS household disposable income divided by the adult population.

Source: PC *National Gambling Survey*, Tasmanian Gaming Commission, and Commission estimates.

Recreational gamblers

Figure C.5 **Demand for gambling by recreational gamblers**



Where:

$p(1+t)_n$ = the price of gambling (including tax 't') faced by recreational gamblers. This is assumed to be (1-the probability of winning).

p_n = price excluding tax.

p^0_n = the price at which demand equals zero for a linear demand schedule (D_n).

q_n = the 'quantity' of gambling product consumed by recreational gamblers at the current price. This is estimated by dividing the known amount of money spent (lost) on gambling in a year by the price.

D_n = the demand schedule for gambling products by recreational gamblers.

ε_n = the price elasticity of demand for gambling products by recreational gamblers estimated around the current price.

The area $[p(1+t)_n * q_n]$ is the total expenditure (loss) by gamblers in a year.

The area $[(p(1+t)_n - p_n) * q_n]$ is the total annual amount of tax revenue collected.

D^0_n = the demand for gambling if gamblers were actually required to pay up front the benefit (consumer surplus) from gambling. Because paying this surplus requires income, less can be spent on all products including gambling. Key influences on the extent of the difference between D_n and D^0_n are the share of income spent on the product and the income elasticity of demand for the product (that is, the extent to which consumption changes as income changes.)

q^0_n = the quantity of gambling consumed by recreational gamblers after adjusting for the effect on income of actually paying consumer surplus.

Consumer surplus is the area above the price line and below the demand schedule. It is a measure of the value that consumers place on the product in excess of the price that they are required to pay for it. In the simple linear example outlined here, the value of consumer surplus 'S' (prior to any adjustment for the effect on income of paying for the surplus) has been estimated by the Commission as:

(1) $$S_n = (p(1+t)_n * q_n)/2\varepsilon_n$$

The adjusted consumer surplus (adjusted for the effect on income of having to pay for the consumer surplus) is estimated by:

(2) $$S^0_n = S_n - 0.5S_n(\varepsilon^i_n)(s_n)$$

where:

ε^i_n = income elasticity of demand for gambling by recreational gamblers.

s_n = share of gambling expenditure in income.

This method of estimating the adjusted surplus is from Willig (1976).

The total benefit from the consumption of gambling by recreational gamblers is calculated as the adjusted consumer surplus plus the total tax revenue collected [the shaded area in figure C.5].

Note that this slightly overstates the benefit as it includes all the tax collected at the current level of consumption (q_n) to the extent of the triangular area (a) in figure C.5. Adjusting for this is, however, quite complex, and the difference is small (less than 1 per cent) in the overall estimate of consumer surplus, and has thus not been presented in the Commission's estimates.

Problem gamblers

For problem gamblers, two calculation have been made. First, the calculation of the benefit (adjusted consumer surplus and tax) on the basis of their existing observed demand. The method of calculation is the same as for recreational gamblers and assumes that problem gamblers are fully rational in their consumption. The calculation uses equations (1) and (2) incorporating information on the expenditure by problem gamblers, their elasticity of demand, income elasticity, and share of income spent on gambling at their current level of activity.

The second calculation assumes that problem gamblers are not rational consumers in the traditional sense and consume gambling at their current high levels 'involuntarily'.

To make the second calculation, the Commission has compared existing levels of gambling by problem gamblers with 'normal' levels of expenditure. The Commission has estimated the 'non-problem' or recreational level of spending by problem gamblers using information on the level of spending of regular recreational gamblers. Such an approach assumes that any gambling activity in excess of the assumed 'non-compulsive' level does not represent value-for-money for the problem gambler and represents a loss rather than a benefit to the gambler.

Box C.2 Estimating spend by problem gamblers in the absence of their compulsion

The Commission looked at the median per capita outlay of regular recreational players in each mode (except for table games, where the median for all recreational gamblers was chosen) as the base for its estimate of the alternative spend by problem gamblers.

The median was chosen rather than the average, because the average is skewed by a few heavy gamblers. That is, the average is not representative of the behaviour of most regular recreational gamblers, whereas the median is more representative of what most of them spend.

In the case of casino table games, the median of all recreational gamblers was chosen rather than the median of regular recreational gamblers, because there are very few regular recreational gamblers in this category. The characteristic mode of play for NPGs in the casino table game category, even 'enthusiastic' recreational players, appears not to play weekly.

The elements of the calculations were as follows:

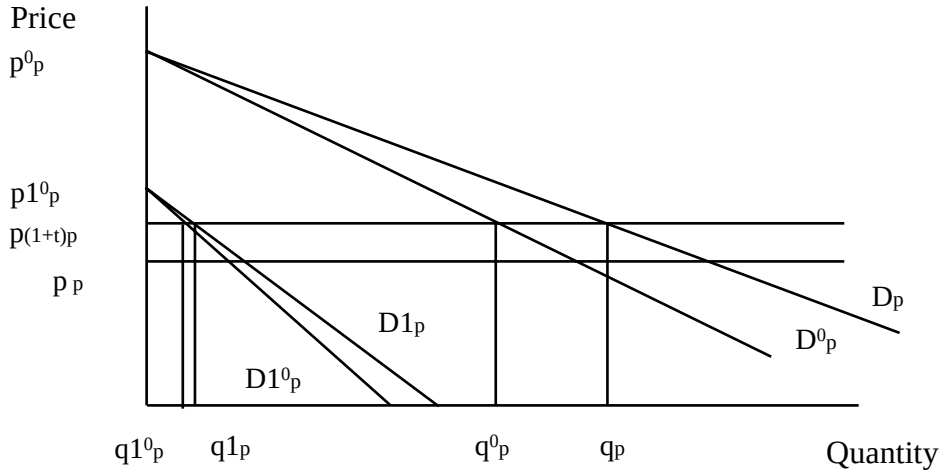
- Calculate the median of outlays per head of regular recreational gamblers in each mode, except for casino table games where the median of all recreational gamblers was used.
- Calculate the ratio of reported expenditure (loss) to reported outlays for all NPGs for each mode of gambling. This accounts for the lower tendency of non-problem (recreational) gamblers to recycle their winnings.
- Multiply the median outlay per head by this ratio to obtain an estimate of the 'benchmark' expenditure (loss) per head for regular NPGs
- Look at the per head outlays by each problem gambler in each mode. If this is greater than the median outlay for that mode, assume that their recreational level of expenditure is the estimated 'benchmark' amount.
- If their outlay is less than the median, then their expenditure is assumed to be their reported expenditure.

Added together, this provides an estimate of what the expenditure by problem gamblers would be if their spending patterns were similar to that of regular recreational players.

Adjust the total of expenditure to match the known expenditure as reported by the Tasmanian Gaming Commission and the ABS.

The reason that problem gamblers in each mode were identified as those outlaying more than the median and those outlaying less than the median is that, in each individual mode of gambling there are a number of problem gamblers whose primary mode of gambling is different from the one in question. It would be unrealistic to assume that those who spend little in that particular mode would increase their expenditure to the level of regular recreational gamblers in that mode.

Figure C.6 **Demand for gambling by problem gamblers**



For current consumption:

$p(1+t)_p$ = the price of gambling (including tax 't') faced by problem gamblers. This is assumed to be (1-the probability of winning).

p_p = price excluding tax.

p^0_p = the price at which demand equals zero assuming (for simplicity) a linear demand schedule (D_p).

q_p = the 'quantity' of gambling product consumed by problem gamblers at the current price. This is estimated by dividing the known amount of money spent (lost) on gambling in a year by the price.

D_p = the demand schedule for gambling products by problem gamblers.

ε_p = the price elasticity of demand for gambling products by problem gamblers estimated around the current price.

The area $[p(1+t)_p * q_p]$ is the total expenditure (loss) by problem gamblers in a year.

The area $[(p(1+t)_p - p_p) * q_p]$ is the total annual amount of tax revenue collected on the expenditure by problem gamblers.

D^0_p = the demand for gambling if gamblers were actually required to pay the consumer surplus associated with consuming gambling products.

q^0_p = the quantity of gambling product consumed by problem gamblers after adjusting for the effect on income of actually paying consumer surplus.

For 'normal' level of consumption:

$q1_p$ = the 'quantity' of gambling product consumed by problem gamblers at the current price if they consumed at a 'normal' level.

$D1_p$ = the demand schedule for gambling products by problem gamblers if they consumed at a 'normal' level.

$\varepsilon 1_p$ = the price elasticity of demand for gambling products by problem gamblers if they were to consume gambling products in the same way as recreational gamblers.

$p1^0_p$ = the price at which demand equals zero, assuming for simplicity a linear demand schedule ($D1_p$) for the 'normal' level of consumption.

The area $[p(1+t)_p * q1_p]$ is the total expenditure (loss) by problem gamblers in a year if they consumed at a 'normal' level.

The area $[(p(1+t)_p - p_p) * q1_p]$ is the total annual amount of tax revenue that would be collected on the expenditure by problem gamblers if they consumed at a 'normal' level.

$D1^0_p$ = the demand for gambling if gamblers were actually required to pay the consumer surplus associated with consuming gambling products if they consumed at a 'normal' level.

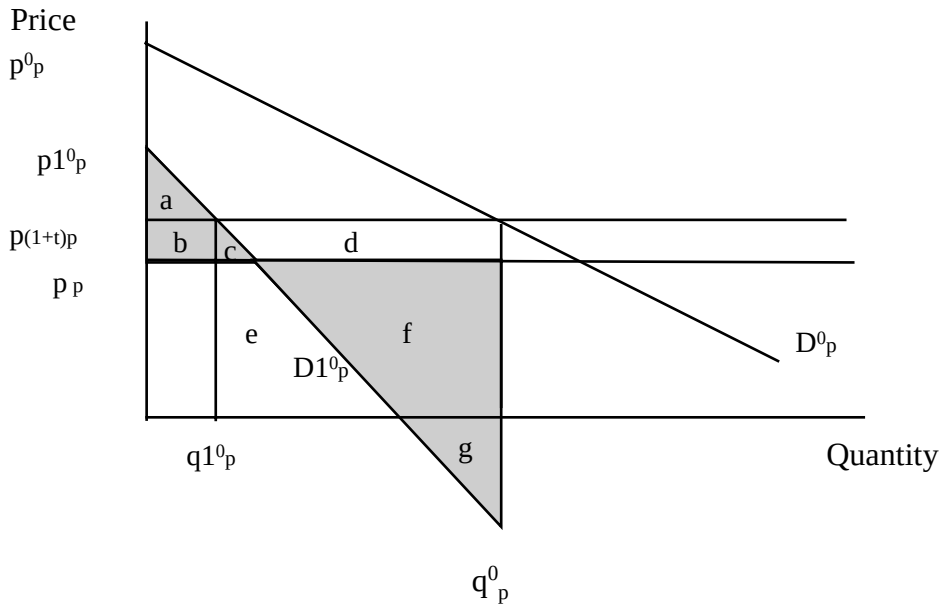
$q1^0_p$ = the quantity of gambling product consumed by problem gamblers after adjusting for the effect on income of actually paying consumer surplus if they consumed at a 'normal' level.

The Commission has calculated the benefit for problem gamblers as follows:

- the adjusted surplus on the 'normal' level of gambling ($S1^0_p$) [the triangular area 'a' in figure C.7]; plus
- the tax on the adjusted 'normal' level of gambling [the rectangular area 'b']; less
- expenditure on gambling by problem gamblers in excess of the adjusted 'normal' level [areas 'c', 'd', 'e', and 'f']; plus
- the satisfaction gained from the 'excess' gambling [the triangular area 'c' and 'e']; plus
- the tax collected on 'excess' spending [the rectangular area 'c' and 'd'].

- the triangular area 'g' which can be seen as representing consumption in excess of a satiation point (box C.3) has not been included in the calculations.

Figure C.7 **Areas included in the calculation of the benefit for problem gamblers**



This figure has, for simplicity, been drawn using only the income adjusted demand schedules.

Note that the tax revenue for recreational gamblers is a net benefit to society as the consumer receives benefits in the form of satisfaction to cover the cost including the tax paid. As the tax paid is in excess of the cost of producing the product, it represents a net benefit to those in receipt of the tax revenue but not a loss to those paying the tax. For problem gamblers, the tax on gambling in excess of the 'normal' level of consumption represents a gain to others, but it is a cost to the problem gambler because it is not matched by 'normal' satisfaction from consumption. Thus, the tax collected from this group is not an unambiguous gain for society.

The adjusted surplus on the 'normal' level of gambling for problem gamblers ($S1^0_p$) is estimated using equations (1) and (2) as it is for recreational gamblers, together with information on the assumed level of 'normal' consumption. The 'normal' level of gambling is presumed to be twice the per capital level of recreational gamblers multiplied by the estimated number of problem gamblers.

The adjusted 'normal' level of expenditure 'E' is estimated as:

$$E = p(1+t)_p * q1^0_p$$

where: $q1^0_p$ (the quantity consumed at the 'normal' level of expenditure adjusted for the income effects of paying the surplus) is estimated by:

$$q1^0_p = (2*S1^0_p)/(p1^0_p - p(1+t)_p \text{ where:}$$

$$p1^0_p = (2*S1_p/q1_p) + p(1+t)_p$$

The tax on the adjusted 'normal' level of expenditure is estimated using the known ratio of tax collected on all expenditure and applying this to the adjusted 'normal' level of expenditure.

Gambling by problem gamblers in excess of the 'normal' level is estimated by subtracting the adjusted 'normal' level from the total amount spent by problem gamblers in a year.

The satisfaction gained from the 'excess' spending [the area 'c' and 'e' in figure C.7) is estimated as:

$$\text{adjusted 'normal' expenditure} * (\varepsilon 1_p/2)$$

The difference between the value of spending on gambling in excess of the 'normal' level and the satisfaction gained from this 'excess' spending can be seen as a measure of the extent to which problem gamblers do not get value-for-money for their spending. Another way of looking at this is to say that the economy is using resources to produce a good whose 'true' value to consumers (as indicated by the 'normal' demand schedule) is less than the cost of the resources being used.

The tax collected on 'excess' gambling is estimated by subtracting the estimated tax that would be collected on the adjusted 'normal' level of gambling from the total amount of tax collected on spending of problem gamblers.

Box C.3 **'Satiation'**

Note that the demand schedule representing the 'normal' level of demand typically intersects the zero price line at a quantity considerably less than the quantity currently consumed by problem gamblers. In essence, this is saying that recreational gamblers, even if the price of gambling were zero, would not consume as much of the product as problem gamblers. For recreational gamblers this can be seen as a situation where you would need to pay them to spend as much time and effort on gambling as problem gamblers, in effect a negative price. This situation represents satiation effects of high levels of consumption. There is therefore, potentially an area below the zero price line [area 'g' in figure C.7] which could be added to our estimate of lack of value for money for problem gamblers. The Commission has not included this in its estimates of the net benefit for gambling.

The Commission's treatment falls between the two approaches typically taken by those estimating costs and benefits for gambling. Many studies of the costs of gambling treat all the expenditure by problem gamblers as a cost and presume that problem gamblers receive no benefit at all in exchange for their expenditure. The alternative approach treats the consumption of gambling in the same way as other products. This means that problem gamblers' surplus is very large. This latter approach assumes that, as problem gamblers choose to gamble at that level, they do so because the benefits exceed or are matched by the cost, including all the other costs in the form of unhappiness, marriage breakdown etc that are borne by the problem gambler.

The Commission has considered that both the approaches are unrealistic. Arguably there is some benefit gained by problem gamblers from their activity — all their expenditure cannot be considered to represent a net cost. Conversely, it is equally unrealistic to presume that problem gamblers consumption decisions are fully informed and perfectly rational.

Total benefits are the sum of the benefits estimated for recreational gamblers and the value of benefits (typically negative) estimated for problem gamblers.

C.4 The results

The estimates of consumer surplus for recreational, problem and all gamblers and for different forms of gambling are presented in the following tables.

Table C.5 **Estimated consumer surplus retained by recreational gamblers 1997-98 ($ million)**

	Range
Wagering	410 — 666
Lotteries	427 — 693
Scratchies	77 — 124
Gaming machines	1 404 — 2281
Casino games	305 — 495
Other	129 — 210
All gambling	**2 745 — 4 460**

Source: PC estimates.

Table C.6 **Estimated loss for problem gamblers, 1997-98 ($ million)**

	Annual spending by moderate problem gamblers	*Annual spending by severe problem gamblers*	*Loss for moderate problem gamblers*	*Loss for severe problem gamblers*
Wagering	152	377	76 — 77	315 — 315
Lotteries	43	24	20 — 20	7 — 7
Scratchies	28	19	19 — 19	13 — 13
Gaming machines	554	2 156	244 — 245	1 908 — 1 910
Casino games	73	22	18 — 19	(15) — (15)
Other	38	74	18 — 18	59 — 59
All gambling	**889**	**2 673**	**404 — 406**	**2 288 — 2 290**

Figures in brackets mean that problem gamblers receive a net benefit rather than a loss on their gambling expenditure in that category.

Source: PC estimates.

Note that the estimated loss for problem gamblers varies little between the two sets of elasticities used by the Commission. The reason for this that there are two offsetting effects from changing the elasticity of demand. For example, with a lower elasticity, the 'normal' demand schedule ($D1^0p$ in figure C.7) rotates around the point where it intersects the price line. As a consequence, the consumer surplus benefit to consumers (area *a*) increases, but the size of the loss area *f* also increases.

By chance, with the elasticities chosen by the Commission to represent demand by recreational gamblers (-0.8 and -1.3) these two effects almost exactly cancelling out (box C.4).

Table C.7 **Estimates of consumer surplus: all gambling (1997-98) ($ million)**

		High elasticity	*Low elasticity*
Spending by recreational gamblers		7 209	7 209
Recreational gamblers' consumer surplus	a	2 745	4 460
Spending by problem gamblers		3 562	3 562
Apparent surplus from problem gamblers	b	1 440	3,841
Tax, licence fees and community contributions	c	4 312	4 312
Total benefit if *all* consumers are 'rational'	(a+b+c)	8 497	12 613
Spending if problem gamblers consume at the rate of recreational regular gamblers		438	438
Surplus on problem gamblers' reduced spend	d	165	267
Loss on excess spending by problem gamblers	e	(2 856)	(2 963)
Net loss for problem gamblers	f = (d-e)	(2 692)	(2 696)
Adjusted consumer surplus	(a+c+f)	4 365	6 076

a Figures in brackets represent a loss

Source: PC estimates.

Box C.4 **Explaining the lack of variation in problem gambler loss**

The change in the net benefit/loss position for problem gamblers is determined by the difference between the net position for problem gamblers under the high elasticity scenario and the net position under the low elasticity scenario.

(A) $\Delta NP_0 = \{(E*0.5*1/\varepsilon_0) – (H - E*0.5*\varepsilon_0)\} – \{(E*0.5*1/\varepsilon_1) – (H – E*0.5*\varepsilon_1)\}$

Where:

E = expenditure in the absence of the gambling compulsion.

H = 'excess' spending by problem gamblers, being their current expenditure less E.

ε_0 = high demand elasticity (-1.3); and

ε_1 = low demand elasticity (-0.8).

The relationship above simplifies into

(B) $\Delta NP_0 = E*0.5*(1/\varepsilon_0 + \varepsilon_0 – 1/\varepsilon_1 – \varepsilon_1)$

As it happens, the two elasticities chosen to represent the alternative demand characteristics of recreational gamblers (-1.3 and -0.8) happen to be very close to the inverse of each other. Thus in the formula above, the expression in the brackets largely cancels out leaving little change in the net position of problem gamblers.

Similarly, the closer the elasticities are to a unitary elasticity (-1) the smaller will be any change. For example:

let $\varepsilon_0 = (1-m)$; and

$\varepsilon_1 = (1+m)$.

Placing these expression in formula (B), the expression for the change in the net position becomes:

(B) $\Delta NP_0 = E*0.5*(2m^3/(1-m^2))$

As m approaches zero, then the denominator approaches one and the numerator approaches zero, leaving a change approaching zero.

Table C.8 **Estimates of consumer surplus by type of gambling: 1997-98 ($ million)**

	Consumer surplus for recreational gamblers	*Tax, licences and community contributions*	*Consumer loss for problem gamblers*	*Net total benefit/surplus*
Wagering	410 — 666	611	391 — 392	629 — 885
Lotteries	427 — 693	832	27 — 27	1 232 — 1 498
Scratchies	77 — 124	174	32 — 32	219 — 266
Gaming machines	1 404 — 2 281	2 365	2 152 — 2 155	1 617 — 2 491
Casino games	305 — 495	280	3 — 4	580 — 769
Other	129 — 210	51	77 — 77	103 — 184
All gambling	**2 745 — 4 460**	**4 312**	**2 692 — 2 696**	**4 365 — 6 076**

Source: PC estimates.