AN EMPIRICAL INVESTIGATION INTO THE EFFECT OF GAMBLING INDUSTRIES ON MEDIAN HOUSEHOLD INCOME

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INTRODUCTION

A claim is commonly encountered that the presence of gaming industries will provide an economic benefit to the local area due to increased economic activity. The unstated assumption in this claim is that the diversion of household expenditure to gambling at the cost of other forms of expenditure is at least as efficient in generation of employment locally as those forms of expenditure displaced. Gambling is also often claimed to be a valuable tourist industry. It is further claimed that this economic benefit from gaming will offset the harmful effects of gaming so that the net impact on the community is positive.

We found that in terms of economic activity measured by median household incomes there is no relationship between the level of activity in the gaming industry and median household income. For areas on the Victorian border with high levels of per capita expenditure on gaming machines (presumably as a result of gambling tourism) there was a decrease in household income as the level of per capita gaming expenditure increased. Weekly median household income decreased by $1.12 for each $100 increase in annual per capita expenditure on gaming machines with 30% of the variation in weekly median household income being accounted for by variation in annual per capita expenditure on gaming machines.

The productivity commission in their report "Australia's Gambling Industries" quantified the indirect cost of problem gambling to the community. Looking only at the indirect costs, that is excluding actual expenditure on gaming, and ignoring "intangible" costs such as emotional harm, the weekly cost of problem gambling per household across Australia is $2.01 to $7.07. These costs should be treated as a decrease in household expenditure as they are expenditures for which the household gets no benefit. That is they absorb household income and prevent it being spent on household needs.

Our conclusion is that the presence of gambling leads to a net decrease in weekly household income with the effect most marked in those areas with significant gaming industries reliant on tourism. In general the decrease is of the order of $2 to $7, (0.3% to 0.9% of median weekly household income) with the decrease in tourist areas being of the order of $36 to $41 (5% of median weekly household income).

SUMMARY

We chose to use median household income as a measure of economic benefit. Median household income for 160 Local Government areas across NSW was correlated with per capita expenditure on gaming machines based on data provided by the Department of Gaming and Racing in 2003.

For the full data set 0.02% of the variation in household expenditure was accounted for by variation in per capita expenditure on gaming with a $0.60 increase in weekly household income predicted with each $100 increase in annual per capita expenditure on gaming machines.

For the full data set excluding the City of Sydney LGA 0.17% of the variation in household expenditure was accounted for by variation in per capita expenditure on gaming with a $2.27 decrease in weekly household income predicted with each $100 increase in annual per capita expenditure on gaming machines.

For the full data set excluding the City of Sydney LGA and Victorian Border LGA's 0.05% of the variation in household expenditure was accounted for by variation in per capita expenditure on gaming with a $1.93 increase in weekly household income predicted with each $100 increase in annual per capita expenditure on gaming machines.

RESULTS

The effect of the Cost of Problem Gamblers on weekly median household income

The report of the Productivity Commission report entitled "Australia's Gambling Industries" evaluates the costs of problem gambling at between $1.8 billion and $5.6 billion for 1997-1998. If tangible costs only are included, that is emotional costs are excluded, the costs are $0.6 billion to $2.1 billion. The costs excluded from table 9.1 were emotional distress of immediate family, emotional cost of divorce, depression and thought of suicide. The remaining costs are real costs and are incurred by households which contain problem gamblers. The household gets no benefit from these expenditures. Furthermore the expenditures are non discretionary as they will be incurred by any household containing a problem gambler. We have therefore treated these costs as a reduction in household income.

The number of households in Australia in 1996 was 6,281,817. Hence the cost per household per week is $1.83 to $6.43. Adjusting to 2001 for CPI the cost per household per week is $2.01 to $7.07.

Empirical Data in Support

Data is available for the following for LGA's across NSW:

- Median household income
- Per capita expenditure on gaming machines

There is a wide range of expenditure on gaming across LGA's. If the presence of gambling increases household income one would expect the effect to be detectable across the data set especially given some 160 data points. Four data sets were plotted and the Pearson correlation coefficient squared (R^2) and the line of best fit calculated.

The first data set was for all LGA's except for 7 where Median household income for 2001 was not readily available. (The seven left out were Auburn, Bankstown, Bega Valley, Deniliquin, Hunters Hill, Lachlan and Murray). The midpoint of the Median household range was generally taken however for data points with per capita gaming expenditure exceeding $2,000 per annum a more precise Median Household income was linearly interpolated. This was because of the effect of these outliers on the findings. The data set contained two sets of outliers. The first was the City of Sydney with a per capita expenditure on gaming machines of over $6,000. The second was a group of LGA's on the Victorian border with per capita expenditure between $2,000 and $4,000. The LGA's were Wentworth, Balranald, Wakool, Berrigan and Corowa. Another three data sets were plotted.

These were the original set less the City of Sydney, the original set less the City of Sydney and the Victorian Border towns only.

The R^2 value can be construed as saying that the value of R^2 as a proportion of the variation of variable A is attributable to variation in variable B. For example if A was found to increase with increase in B and with an R^2 value of 0.1 one could say that 10% of the variation in B can be attributed to variation in A.

Results

Data set	Description	R^2	Change in weekly household income for each $100 increase in annual per capita expenditure on gaming machines
A	All LGA's	0.0002	$0.60 increase
B	Less City of Sydney	0.0017	$2.27 decrease
C	Less City of Sydney and border towns	0.0005	$1.93 increase
D	Border towns only	0.294	$1.12 decrease

The correlation for data set A is very weak. The outliers have a significant impact on the result. If the City of Sydney is included one could deduce that the presence of gaming is weakly correlated with an increase in household income of $0.60 for every $100 increase in per capita expenditure on gaming machines. Ignoring the City of Sydney (which seems reasonable given the fact that it has a large migrant worker population) the inference would be that the presence of gaming leads to a reduction in household income of $2.27 for every $100 increase in per capita expenditure on gaming machines. It appears from this population that around 0.2% of the variation in Household Income can be attributed to variation in per Capita Gaming expenditure. When the border towns are excluded there is once more a weak correlation with an increase in household expenditure following increase in gaming expenditure.

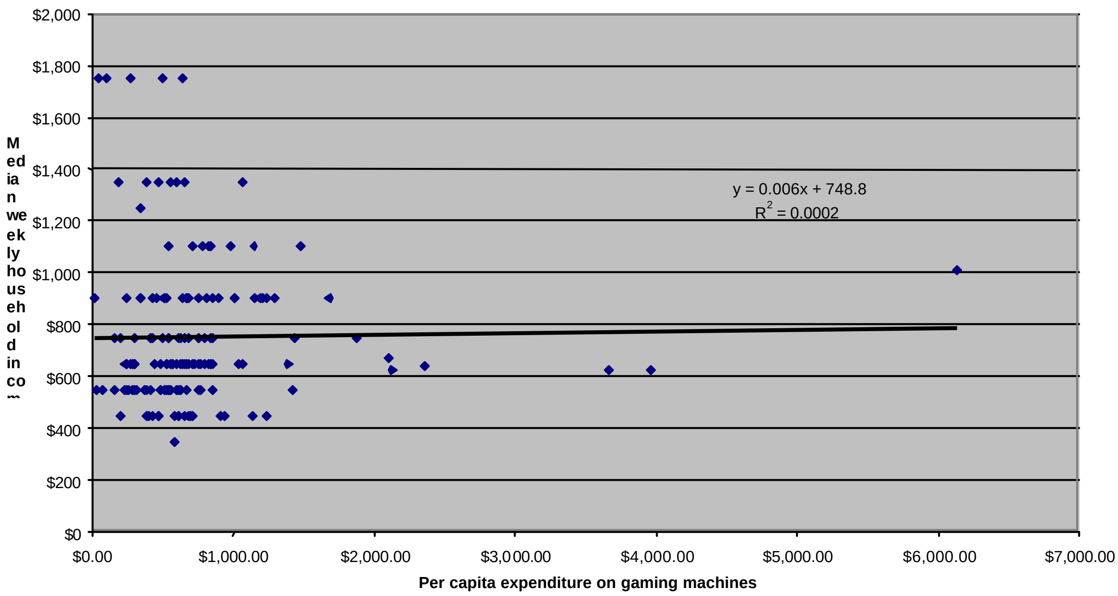
The case of the border towns is particularly interesting. One would expect these towns to show the most marked increase in household income with increase in gambling. In fact as gaming machine expenditure increases, median household income falls by $1.12 for every $100 increase in expenditure on gaming machines. R^2 is quite high being 0.29. In other words around 30% of the variation in household income in these areas can be attributed to variation in per Capita expenditure on Gaming Machines. One should have a high degree of confidence in this finding.

In summary when all data points are included the line of best fit shows an increase in household income with increase in Per Capita Expenditure on Gaming Machines. The effect however is so weak as to be non-existent. Most researchers would agree that with such a low correlation coefficient, the conclusion would be that there is no relationship at all.

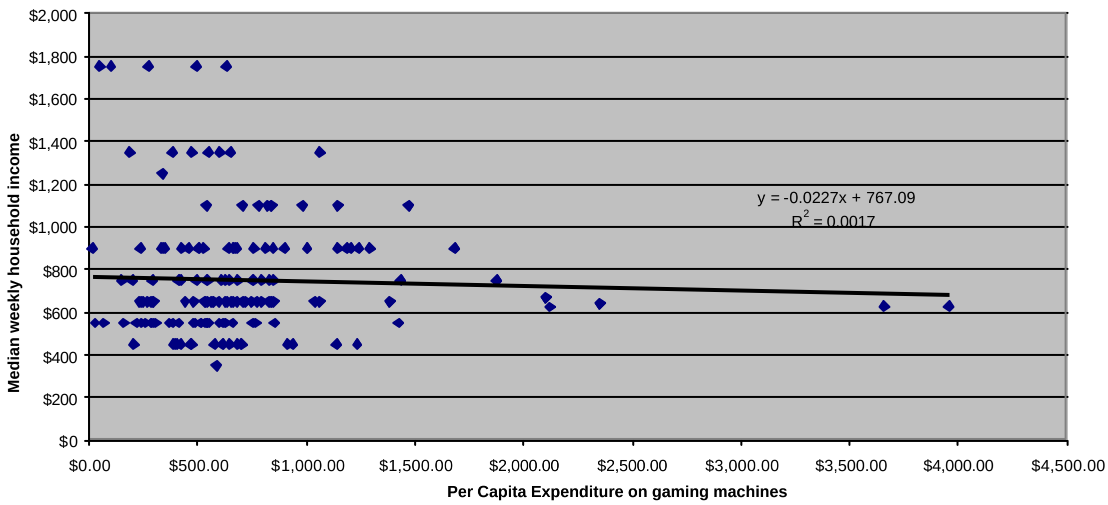
The relationship is an outcome of one data point, the City of Sydney. The City of Sydney is qualitatively different to other LGA's because few of those employed there also live there. It seems reasonable to exclude this point. Once this is excluded the line of best fit shows a decrease in household income with increase in Per Capita Expenditure on Gaming Machines. Again the relationship is very weak. The relationship for the border towns is strong enough to encourage some confidence.

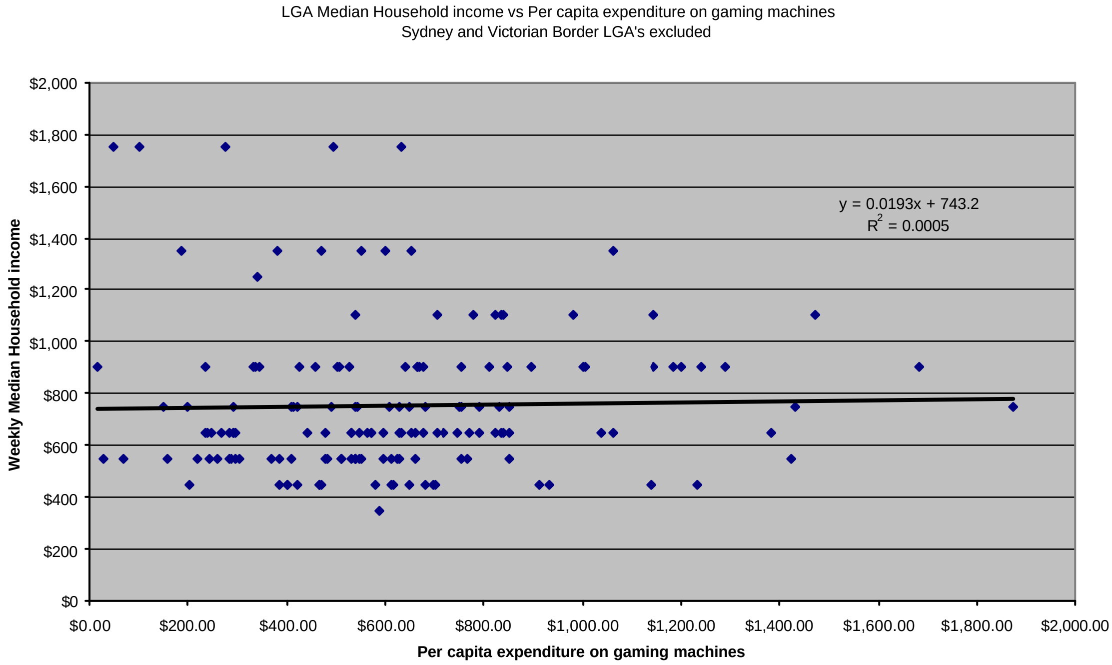
The analysis of the data suggests that Median Household Income decreases with increased expenditure on gaming. Graphs of the various data sets are shown below.

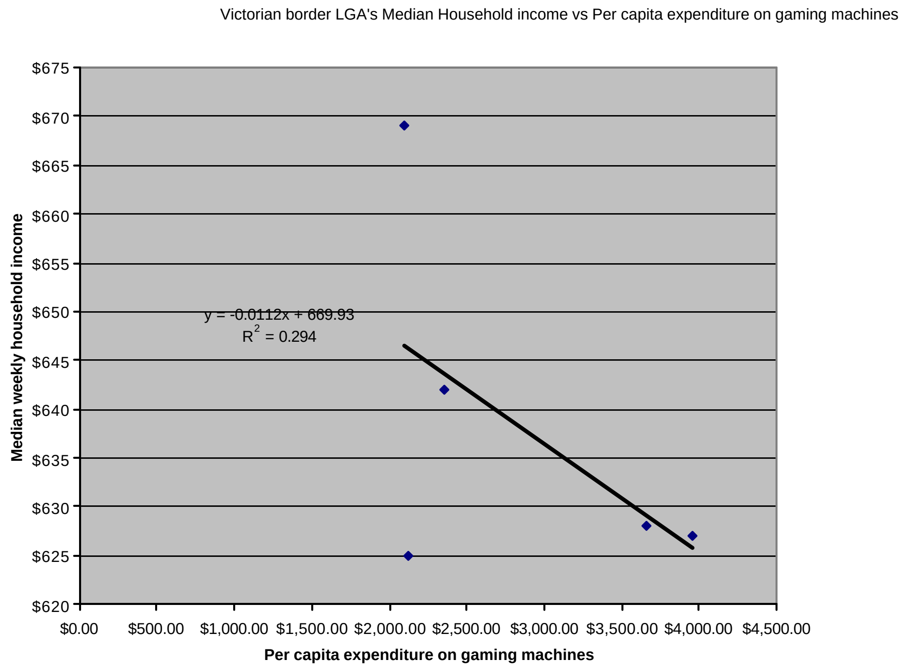
LGA Median Household income vs Per capita expenditure on gaming machines
All LGA's



LGA Median Household income vs Per capita expenditure on gaming machines
Sydney LGA excluded




LGA Median Household income vs Per capita expenditure on gaming machines
Sydney and Victorian Border LGA's excluded
y = 0.0193x + 743.2
R2 = 0.0005
Weekly Median Household income
$2,000
$1,800
$1,600
$1,400
$1,200
$1,000
$800
$600
$400
$200
$0
$0.00
$200.00
$400.00
$600.00
$800.00
$1,000.00
$1,200.00
$1,400.00
$1,600.00
$1,800.00
$2,000.00
Per capita expenditure on gaming machines


Victorian border LGA's Median Household income vs Per capita expenditure on gaming machines
y = -0.0112x + 669.93
R2 = 0.294
Median weekly household income
$675
$670
$665
$660
$655
$650
$645
$640
$635
$630
$625
$620
$0.00
$500.00
$1,000.00
$1,500.00
$2,000.00
$2,500.00
$3,000.00
$3,500.00
$4,000.00
$4,500.00
Per capita expenditure on gaming machines

GAMING PREVALENCE AS AN INDICATOR OF GAMING HARM IN LOCAL COMMUNITIES: SOME POLICY IMPLICATIONS FOR GAMING HARM MINIMISATION IN NSW

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Introduction

Background

There has been ongoing speculation regarding significant factors influencing gaming machine distribution and density, including the link between distribution and access to machines and gaming harm minimisation (PC 1999). A lack of understanding of the efficacy of gambling harm minimisation has also been identified (Banks 2002), and has in part given rise to the current IPART Inquiry into Gambling Harm Minimisation (NSW IPART 2003).

In his speech to the 12th Annual Conference of the National Association of Gambling Studies (2002), Productivity Commission Chairman, Garry Banks noted that there had been considerable progress made on problem gambling since the Commission's 1999 Inquiry.[1] This was in relation to both an increased recognition within government, the gambling industries and the community that there *is* a problem, and to the introduction of a range of regulatory and self-regulatory measures to deal with the issue. He also noted, however, that 'it remains unclear whether

[1] Productivity Commission, 1999, Australia's Gambling Industries, Australian Government, AGPS, Canberra

problem gambling and its associated impacts have moderated' since the introduction of these measures (Banks, 2002, p. ii). Whilst he noted that there is evidence of a maturing gaming market and perhaps some regulatory impact in the slowing of expansion in gaming machine revenue from 1997-98 to 2000-01, Banks also reported that the gaming machine share of the market increased from 52% to 57%. This is significant as the costs of problem gambling were found to 'loom larger for gaming machines' compared with other forms of gambling (ibid, 2002, p. ii). Among the key priorities for government in the current gaming environment, Banks highlighted the need for more research on what actually works in consumer protection mechanisms, and the need for truly independent and transparent research.

A range of studies have been conducted in relation to whether certain demographic or psychosocial characteristics are associated with an increased risk of developing EGM-related problem gambling. [2] Whilst the evidence is somewhat contradictory, there is some agreement on certain factors. In 1999, the Productivity Commission had found that people who are 'separated or divorced, unemployed, living in single person households are more highly represented among problem gamblers', and that 'whilst there is a complex causality, 'a considerable number of problem gamblers are in lower income brackets' (PC, 1999, Chapter 6, p. 56). They likewise found that increased access to gaming machines appeared to be a significant factor in both regular playing patterns and the development of problem gambling (PC, 1999, Chapter 6, p. 4), and that increases in gaming machines in areas of higher density are likely to have a greater impact on levels of problem gambling. [i]

There has also been some concern that the gaming machine industry has been targeting communities (either explicitly or inadvertently) from which it is likely to gain a higher return, and a perception that such communities are more likely to contain people who are poorer, less well educated and less able to sustain a higher volume of gaming expenditure and associated taxation (NSW Gaming Impacts Society, 2002). The Productivity Commission (1999) observed that there may be greater incentives to allocate machines to areas where they will be used most intensively. They noted that, 'the most likely explanation' for the spatial distribution of EGMs is that 'the potential returns are highest in low income areas,

[2] See for example Crofts (2002); O'Neil and Whetton (2002); VCGA (2000); Brown and Coventry (1998).

reflecting consumer preferences'. The Commission notes that 'this can serve to concentrate social costs in communities that are less able to bear them'. This is compounded by 'the withdrawal of income from such communities through the relatively high taxes on gaming machines expenditure' (PC, 1999, Summary, p. 30). As well as the disproportionate impact on certain individuals or groups, then, there are also vulnerabilities that need to be considered in spatial or geographic terms.

Issues of Gaming Machine Access and the SIA Process

The enactment of gambling 'harm minimisation' legislation by the NSW parliament in October 1999, and subsequent amendments to the legislation, was a response to increased community concern about the increase in EGM density, access and expenditure, and associated social and economic effects. Most recently, the introduction of the Gaming Machines Act 2001 and attendant Gaming Machines Regulation 2002 have ostensibly strengthened the requirements for SIAs to be completed for applications for new or additional EGMs in licensed hotel and registered clubs, particularly in relation to Class 2 applications.[ii] In addition to the SIA requirements discussed below, other current harm minimsation provisions include a number of regulatory measures related to technical standards for EGMs, state-level cap[iii] to the number of machines in hotels and clubs; a requirement that so-called 'mega-clubs' reduce their EGMs by 10% over the next 5 years; and a limit of 450 EGMs and 30 EGMs[iv] for other registered clubs and hotels respectively. [v]

Despite these state-level and venue-based caps, however, the SIA process is arguably the only mechanism that has the potential to deal with the issue of spatial concentration of gaming machines within particular local communities in any meaningful way. Whilst state caps may limit the number of machines in absolute terms, it cannot of itself restrict the movement of machines to different local areas, including areas of considerable social disadvantage. Likewise, venue-specific caps may limit or even reduce the number of gaming machines in individual venues, but cannot adequately address the concentration of venues *per se*. Hence a more disadvantaged location may historically have a higher than average concentration of clubs and hotels which also have gaming machines, and this is frequently the case in NSW. In contrast, the SIA process expressly requires the Board to consider the social and economic impact on individual 'local communities', and specifically provides that a Class 2 application cannot be approved unless the Board is satisfied that there will be 'no overall detriment to the local community'. [vi] On the face of it, this is a stringent test.

The SIA process has therefore become a mechanism that has the potential to have an ameliorative impact on access-related harm to problem gamblers from gaming machines. Within this context, it is important to evaluate arguments in the SIAs received by the NSW LAB to date, particularly in relation to factors concerning geographic and temporal access to machines. Two of the more common claims made in SIAs reviewed include a contention that increased access through introduction of additional gaming machines into an area by the industry will lead to a 're-distribution' rather than increase total takings from that local community;[vii] and that the proportion of problem gamblers and their average expenditure has remained constant over time (i.e. fixed in time as at the PC 1999). [viii] These types of considerations go to the heart of the SIA process specifically, and to access-related factors in the harm minimsation debate.

Analysis of Comprehensive Gaming Dataset for NSW 1996-97 and 2001-02

Overview

In order to evaluate these claims by industry SIA consultants, and to shed further light on the question of the impact of increased access to gaming machines across different geographic areas of NSW over time, a preliminary analysis of a comprehensive gaming dataset for NSW for the years 1996/97 and 2001/02 has been undertaken. The data set contains a range of data for each LGA in NSW including: gaming machines per adult (density), average expenditure on EGMs per adult, average takings per EGM for this time period, SEIFA (index of socio-economic disadvantage). The data set was compiled and analysed by the writers from data provided by the NSW Department of Gaming and Racing to one of the authors in her capacity as a member of the Social Impact Assessment Panel.

The following findings, presented in summary here and in detail below, are of particular significance to the debate on effective harm minimsation measures.

1. The amount spent per adult on gaming increases with increasing density of gaming machines. As such, the Productivity Commission's (1999) 'access thesis' would appear to be confirmed by the most recent data set.

2. The amount spent per adult on gaming increases at a greater rate than the increase in gaming machine density generally, and most markedly in areas of lower existing density. This conflicts with claims made by the gaming industry (via consultant preparing SIAs accompanying Class 2 Gaming Machine applications) that existing revenue will be redistributed to a large extent from existing machines to introduced machines in a given local community.

3. Expenditure per adult on gaming is increasing proportionally more rapidly in areas with low density of machines per adult. This may, in part, call into question the Productivity Commission's (1999) proposition that problem gamblers will increase more rapidly through the introduction of gaming machines into areas with an already high density in gaming machines. Whilst problem gamblers (as evidenced by an increase in real expenditure) are likely to increase in areas with already high densities, the impact is likely to be even greater in lower density areas.

4. Importantly, the findings also appear to challenge the orthodoxy (found in gaming industry SIAs) that proportion of problem gamblers and their average expenditure has remained constant over time (i.e. fixed in time as at the PC 1999). Rather, it is highly likely that both the number of problem gamblers, and their average expenditure, has increased significantly, as has the number of recreational gamblers. This is an area that requires more research to establish these relationships 5 years after the Productivity Commission gathered data for their study.

5. There does not seem to be any particular targeting of gaming machines by the gaming industry, either to areas of greater profitability or of high per

adult expenditure on gaming when the changing distribution of machines is considered. However, gaming machines are becoming concentrated in areas of existing high density. It should be noted, however, that areas at the top end of the density range are experiencing a decrease in density of gaming machines per adult. It is possible that this could be through temporal redistribution, including the early impacts of the NSW Government's reduction strategy noted earlier.

6. There are a number of important policy issues associated with the findings. These are outlined here, and in more detail at the conclusion of this paper.

6.1. Any increase in EGMs to any local community or discreet geographic area is likely to lead to an increase in access, takings and thus a proportion of new or existing gamblers who are at risk of moving in to the 'moderate' to 'severe' problem gambling range.

6.2. The greatest harm, in social and economic terms, is likely to be caused from the introduction of gaming machines into local communities which are poor and currently have low densities of machines.

6.3. It appears that the optimum strategy to maximise distributional equity, harm minimisation and industry profit in the current regulatory environment (and given a limited number of gaming licenses available), would be to approve applications which are for machines in areas of high SEIFA index, with high average profit per machine and low existing density of gaming machines. Nonetheless, this would need to be done in the knowledge that it is highly likely that these areas will also experience an increase in problem gamblers through increased density, though perhaps not at as great a rate, and in areas where they maybe more able to sustain the higher level of money and taxation drawn from the local community.

6.4. **Similarly, applications for additional gaming machines in areas with low SEIFA index and higher than average per adult expenditure should be rejected.**

7. Overall, this study strongly indicates that restricting access to gaming machines in the ways noted above may well be the most effective harm minimsation strategy available at present. Further, careful monitoring of the cumulative impacts of the concentration of gaming machines in certain locations over time is vital in evaluating the efficacy of relying on state-government or venue based caps. Given the absence of regional or locality-based caps, and the propensity for the industry to transfer existing licences between venues, it may well be that one of the most effective mechanism for harm minimsation currently open to the NSW State Government is the rigorous SIA process currently in place.

The following reports on a detailed examination of the comprehensive dataset for gaming in NSW for the periods 1996-97 (prior to the introduction of EGMs into NSW and the greater liberalisation of gaming in NSW), and the most recent comprehensive data available (2001-02).

It should be noted that our findings are preliminary and should be subject to critical peer review.

Methodology

Data relating to gaming machines for NSW and for the periods 1996-97 and 2001-02 were provided by the NSW department of Gaming and Racing in August 2003 as part of the information required by one of the writers in her role on the Liquor Administration's SIA Advisory Panel. The data was provided and analysed at the NSW and Local Government Area (LGA) level, as this was the most accessible data. This data was compiled in a comprehensive dataset.

A number of variables that act as indicators for the gaming environment in a given LGA were then calculated or selected. These were 'average profit per gaming machine', 'density of gaming machines per adult', 'expenditure on gaming machines per adult' and 'SEIFA index' (of comparative socio-economic well-being). A linear regression analysis was undertaken between the different variables to examine what significant relationships might exist.

All dollars were adjusted to 2001 values using the CPI. Various factors were correlated using the MS Excel Chart function and trend line function. Factors showing significant correlation were further examined. Confidence intervals were also calculated using MS Excel correlation function.

Data points for Canada Bay were omitted as there was no 1999 data. Data for Murrumbidgee was also omitted as the 1996 data appeared to be in error showing 701 machines but only 65 machines in 2001. This was later confirmed as an error however due to the amount of recalculation required the data point was not reinserted.

The results are summarised below. Appendix A tabulates the results of correlations on the gaming variables selected for analysis.

Findings

As noted above, four variables were considered - 'average profit per gaming machine', 'density of gaming machines per adult', 'expenditure on gaming machines per adult' and SEIFA index (of comparative socio-economic well-being). Each of these gaming variables, and their relationship to other variables, is considered in turn below, and tabulated at *Appendix A*. The scale of analysis is the 173 LGAs in NSW.

Average profit per gaming machine

i) Correlation with people per gaming machine

For 1996 log average profit per gaming machine vs People per gaming machine had R^2 =0.10. For 2001 R^2 =0.0006. As such, the average profit per machine appears to be largely independent of the density of machines.

ii) Correlation with Amount spent per Adult on Gaming

For 1996 log average profit per gaming machine vs log Amount spent per Adult had R^2 =0.55. For 2001 R^2 =0.34. There appears to be a relationship between these two variables however it appears the relationship is becoming weaker with time. For 2001 the relationship can be calculated as follows:

Y = 0.97 x – 3.6

Y = ln $/P   x = ln $/GM

Where $ = total takings, P = number of persons and GM = number of gaming machines.

ln($/P) = 0.97 ln ($/GM) – 3.6

ln($/P) = ln ($/GM)^0.97 – 3.6

e ^ Ln($/P) = e^ (ln ($/GM)^0.97 – 3.6)

e ^ Ln($/P) = e^ (ln ($/GM)^0.97) X e^(– 3.6)

$/P=($/GM)^0.97 X 0.027

$/P~($/GM) X 0.027

This can be further reduced by dividing by $:

GM/P~0.027

This suggests that the average 'number of people per gaming machine' is 37 and that knowing the number of people in an LGA will predict 30% of the 'number of gaming machines'. The result is inconsequential. The relationship is better understood from the distribution, which has been graphed separately. In 2001 the mean was 63 with a standard deviation of 77. The 95th percentile equated to 0.51 standard deviations and the 98th percentile equated to 0.72 standard deviations. In 1996 the mean was 74 with a standard deviation of 97. The 95th percentile equated to 0.56 standard deviations and the 98th percentile equated to 0.70 standard deviations.

In summary the distribution is widespread about the mean. The shape of the distribution has changed with time.

iii) Correlation with SEIFA index

The relationship between 'SEIFA index' and 'Average Profit per Gaming Machine' is weak with $R^2 = 0.10$. This can be interpreted as SEIFA index predicting 10% of the variation in Average Profit per Machine in 2001 (Up from 4% in 1996).

The relationship is $/GM=78*SEIFA - $47,000. Presumably Gaming Machines in more well off areas take significantly more per machine than gaming machines in less well off areas. Having said that SEIFA is not a good predictor of takings per machine as areas with the same SEIFA index can have a threefold variation in takings per machine. The 95% confidence interval is +/- $35,000 (+/- 2.5 standard deviations) and the 80% confidence interval is +/- $23,000 (+/- 1.6 standard deviations).

People per Gaming Machine

i) Correlation with Amount spent per Adult on Gaming

For 1996 ln people per gaming machine vs ln Amount spent per Adult had R^2 =0.64. For 2001 R^2 =0.63. There appears to be a *significant relationship* between these two variables. Calculating from the log relationship it appeared that the relationship was actually linear.

The relationship was replotted as 'gaming machines per person' versus 'amount spent per adult'. For 2001 R^2 =0.77 (correlation coefficient R=0.88). **This means that knowing the 'density of gaming machines' one can predict 77% or over three quarters of the variation in 'per adult expenditure' on gaming.**

For 2001 the relationship is as follows:

\$/P = 33 243 (GM/P) – 69.7

The mean is 0.016 Gaming machines per Adult with a Standard Deviation of 0.013.

	GM/P		**\$/P**	
		Percent change		Percent change
Minus 1 SD	0.003		\$30	
Mean	0.016	530%	\$462	1540%
Plus 1 SD	0.029	180%	\$894	194%

As can be seen above an increase of 1 SD from the mean number of 'gaming machines per person' results in a disproportionate increase in the expenditure per adult, by a factor of three going from minus 1 SD to the mean greater than the increase in the number of machines and by 8% going from the mean to plus 1 SD.

The 95% confidence interval is +/- \$87 (+/- 0.1 standard deviations) and the 80% confidence interval is +/- \$57 (+/- 0.1 standard deviations). This is to be expected from the high R^2 value.

For 1996 R^2 =0.88. This means that knowing the density of gaming machines one can predict 88% of the variation in Per Adult Expenditure on Gaming.

The relationship is as follows:

$/P = 26 799 (GM/P) – 70.1

The mean is 0.014 Gaming machines per Adult with a Standard Deviation of 0.010.

	GM/P		**$/P**	
		Percent change		Percent change
Minus 1 SD	0.004		$37	
Mean	0.014	350%	$305	824%
Plus 1 SD	0.024	160%	$579	190%

The 1996 model was somewhat more sensitive to increase in ‘gaming machine numbers’. It should be noted however that the rate of increase (i.e. the slope) has gone up by about 22% over the period. For the same change in density, $/P in 2001 goes up by 22% more than it did in 1996.

The finding is significant. While one could debate which if either is a dependent variable, it seems likely that per adult expenditure on gaming increases directly, and in fact disproportionately higher, as the density of gaming machines increases. Further more the rate of the increase in per adult expenditure has itself increased over the period. This is borne out by empirical data, which shows that the amount of money spent on gaming continues to increase, and to increase at a greater rate than the increase in the numbers of gaming machines.

It could be that the density is increasing as a result of the per Adult expenditure being high (i.e. the market is chasing areas of high per adult expenditure) but this seems unlikely. It would be expected that a rational market would use takings per machine as an indicator of the best place to place gaming machines; however, there is only a weak relationship between takings per machine and density of machines.

Irrespective of impetus, it is clear that the number of problem gamblers as well as the number of recreational gamblers is highly likely to be increasing (not temporally constant) as either more people are gaming, same number of people are spending more, or more likely, a combination of the two.

ii) Correlation with SEIFA index

There is a weak relationship between SEIFA and density of gaming machines. For 1996 log people per gaming machine vs SEIFA had R^2 =0.20. For 2001 R^2 =0.24. For 1996 the relationship can be calculated as follows:

Y = 37.9 x + 838 where x = ln (P/GM) and Y = S P=population, GM = number of gaming machines and S = SEIFA index

S = 37.9 ln (P/GM) + 838

(S – 838) = ln (P/GM)

P/GM = e ^ ((s-838)/37.9)

GM/P = e ^ ((838 – s)/37.9)

For 2001 the relationship can be calculated as follows:

Y = 45.0 x + 815 where x = ln (P/GM) and Y = S P=population, GM = number of gaming machines and S = SEIFA index

S = 45.0 ln (P/GM) + 815

(S – 838) = ln (P/GM)

P/GM = e ^ ((s-815)/45.0)

GM/P = e ^ ((815 – s)/45.0)

	1996		**2001**	
	SEIFA	GM/P	SEIFA	GM/P
	991	0.018	991	0.02
	934	0.08	934	0.07
% change	6.1%	340%	6.1%	250%

It appears that as 'SEIFA' decreases the 'density of gaming machines' increases at a highly disproportionate rate. However, the concentration of gaming machines in low SEIFA areas has decreased over the period from 1996-97 to 2001-02.

Amount spent per adult on gaming

i) Correlation with SEIFA index

There is no significant relationship between SEIFA index and per adult expenditure on gaming.

The change in the three variables over time

i) Amount spent per adult

There was a strong relationship between Amount spent per Adult in 1996 and in 2001 with $R^2 = 0.96$. (Correlation coefficient R=0.98).

The relationship is linear being:

$\$/P_{2001} = \$/P_{1996} + 178$.

The 95% confidence interval is +/- $29 (+/- 0.04 standard deviations) and the 80% confidence interval is +/- $19 (+/- 0.03 standard deviations). This is to be expected from the high R^2 value.

'Per adult expenditure' has increased by $178 over the period with a 95% confidence interval of $149 to $207. Further more the distribution of 'per adult expenditure' is unchanged. **It has increased evenly across all areas.**

ii) People per Gaming Machine

There was a strong relationship between 'people per gaming machine' in 1996 and in 2001 with $R^2 = 0.88$.

The relationship is linear being:

$P/GM_{2001} = 0.75\ P/GM_{1996} + 7.8$.

For 1996 the mean was 74 with a SD of 97.

Standard Deviation	**People per Gaming Machine**		**Gaming Machines per Person**		**GM/P 2001 absolute change**	**GM/P % change 2001**
	1996	2001	1996	2001		
-0.5	25.5	27	0.039	0.037	-0.002	-5.1%
-0.25	50	45	0.020	0.022	0.002	40.5%
0	74	63	0.014	0.016	0.002	27.3%
+0.25	98	81	0.010	0.012	0.002	25.0%
+0.5	122	99	0.008	0.010	0.002	16.7%

The 95% confidence interval is +/- 5.0 People per Gaming Machine (+/- 0.05 standard deviations) and the 80% confidence interval is +/- 3.3 People per Gaming Machine (+/- 0.03 standard deviations). This is to be expected from the high R^2 value.

There are two parts to the relationship. First all areas above a threshold value of 'people per gaming machine' have had an increase in gaming machines; however, areas with higher densities are getting a lesser relative increase, even though the increase is the same in absolute 'per adult increase' across all areas. Areas below the threshold have had a decrease in gaming machines, with the threshold level being 31.2 People per Gaming Machine. This threshold is 0.44 standard deviations above the mean.

There has been a *transfer* of machines from areas with fewer than 31.2 'people per gaming machine' to areas with *more* people per gaming machine. At the same time additional machines have been introduced, typically into areas with a density of 'gaming machines per adult' less than the threshold.

iii) Profit per Gaming Machine

There was a reasonably strong relationship between 'average profit per gaming machine' in 1996 and in 2001 with $R^2 = 0.75$.

The relationship is linear being:

$\$/GM_{2001} = \$/GM_{1996} + 6150$.

The 95% confidence interval is +/- $2,400 (+/- 0.16 standard deviations) and the 80% confidence interval is +/- $1,500 (+/- 0.11 standard deviations). This is to be expected from the high R^2 value.

'Average profit per gaming machine' has increased by $6,150 over the period with a 95% confidence interval of $3,750 to $8,550. Further more the distribution of 'per adult expenditure' is largely unchanged. It has increased reasonably evenly across all areas.

Factors contributing to increase in Gaming Machine density and expenditure on Gaming Machines

i) There was a weak relationship between increase in Gaming Machine density and ln of Gaming Machine Density in 1996 with $R^2 = 0.22$. The relationship is:

$Y = - 0.11 x + 0.33$ where $x = \ln(P/GM)$ and Y=% increase

$\% = -0.11 \ln (P/GM) +0.33$

$\% = 0.11 \ln (GM/P) + 0.33$

This predicts that an area with a density of 10 (0.1 GM/P) in 1996 would have an increase of 8%. An area with a density of 50 (.02 GM/P) in 1996 would have an increase of –10%.

There is a weak trend for gaming machines to become concentrated in areas of already high density, and to become less concentrated in areas of low density. This is somewhat in conflict with the findings above. The explanation is probably that the threshold mentioned above the average. In other words areas with high densities of ‘gaming machines per adult’ have had a decrease in gaming machines. However, areas with above average to high densities have had an increase in ‘gaming machines per adult’.

ii) There was a weak relationship between increase in per Adult Expenditure on Gaming Machines and ln of 1996 average profit with $R^2 = 0.32$. The relationship is:

Y = - 1.2 x + 13 where x = ln($/GM) and Y=% increase

% = -1.2 ln ($/GM) + 13

This predicts that an area with a 1996 average profit of $31,000 will have an increase in Per Adult Expenditure on Gaming Machines of 58%. An area with an average profit of $50,000 will have an increase of 2%. **It appears that per adult expenditure on gaming is growing most rapidly in areas with low average profit.**

iii) There was a relatively strong relationship between increase in Expenditure per Adult on Gaming Machines and Gaming Machine Density in 1996 with $R^2 = 0.45$.

The relationship is:

% = 0.009 (P/GM) +0.07

This predicts that an area with a density of 10 (0.1 GM/P) in 1996 would have an increase of 16%. An area with a density of 50 (.02 GM/P) in 1996 would have an increase of 52%.

There is a weak trend for ‘expenditure per adult’ on gaming to increase more in areas with ‘low density of machines’ per adult.

The finding is complementary to others above.

Summary of Findings

i) Strong relationships

Areas with high per adult expenditure in 1996 continue to have high per adult expenditure and the distribution of per adult expenditure has remained unchanged.

Gaming machine densities from 1996 to 2001 have generally increased across the board but at a greater rate in areas with lower densities. Areas with densities in the high end of the range, below a value of 31.2 people per gaming machine, have had a decrease in gaming machine density.

Areas with high Average Profit per Gaming Machine continue to have high Average Profit per Gaming Machine and the distribution of Average Profit has remained unchanged.

ii) Relatively strong relationships

The amount spent per adult on gaming increases with increasing density of gaming machines. The amount spent per adult on gaming increases at a greater rate than the increase in gaming machine density and most markedly in areas of lower existing density.

Expenditure per adult on gaming is increasing proportionally more rapidly in areas with low density of machines per adult.

iii) Weak relationships

Machines in areas with higher SEIFA indexes tend to take a greater Average Profit per Gaming Machine however SEIFA index is a poor indicator of Average Profit per Gaming Machine.There tends to be a significantly greater density of Gaming Machines in areas with lower SEIFA indexes.

Gaming machines are becoming concentrated in areas of already high density. (However this is not true of areas of very high density, which show a decrease in density of machines per adult).

Per Adult Expenditure is growing most rapidly in areas with low average profit.

iv) Null relationships

There is no relationship between SEIFA index and expenditure per adult. Similarly, there is no relationship between % increase in gaming machines and average profit or per adult expenditure. There is also no relationship between density of gaming machines and average profit per gaming machine.

DISCUSSION

Policy Issues

A number of key considerations for gaming machine policy and regulation in relation to harm minimisation arise from our study on temporal and geographic trends in gaming machine access / distribution from 1996-97 to 2001-02. These are harm minimisation, profit maximisation and marketing. Each of these is outlined below.

Harm Minimisation

A major harm from gaming comes from diversion of funds within the community from necessities of life to gaming, and the range of individual, family and community harm that arises from this (PC 1999). Areas with low SEIFA index appear to carry a large proportion of the cost of gaming. However, it is likely that these same areas have a much lower proportion of discretionary expenditure available to fund gaming.

In policy terms, new gaming machine applications in areas of low SEIFA index and existing high density of gaming machines or high per adult expenditure on gaming should generally be refused, as all of the evidence points to these areas as at greatest risk of problem gambling and its social and economic effects. Further, there needs to be more pro active steps to limits and reduce number of EGMs within these areas (eg via locality-based caps, and more stringent de-concentration strategies).

It should also be noted that **the introduction of gaming machines into an area of low gaming machine density will have an immediate effect on the community as the per adult expenditure increases at something like three to four times the increase in machines**. In a poor community introduction of gaming machines could take people from making ends meet to poverty. For example taking a community from minus 1 SD of Gaming Machines per adult to an average number of Gaming Machines per Adult is likely to increase per capita Adult Expenditure from $30 to $462.

Importantly, there is merit in protecting poor communities that are not yet exposed to gaming machines. That is, those low to moderate income areas that may be effectively 'green fields' sites (e.g. new release areas in outer urban or regional areas), are likely to be seriously affected by the introduction of EMGs.

Profit Maximisation

To maximise the return from gaming machines, the optimum strategy would be to place the machines in areas with high takings per machine. It is likely (around 80%) that additional machines will take the same as existing machines. The high takings per machine are more likely (10%) to be found in areas with high SEIFA indexes, however, machines are more likely to be found in areas of low SEIFA index (24%).

An industry profit maximisation strategy would therefore be to relocate gaming machines to area with a higher SEIFA index and high takings per machine. It is unclear from the analysis undertaken in this study how long, if ever, it would take or such areas to reach saturation point, and for profits to plateau or decline, though their growth may slow proportionally as noted by Banks (2002).

However, ethical concerns arise with regard to such active targeting, as these areas will also disproportionately suffer the social impacts of increased problem gambling, though they may on a superficial analysis be more able to sustain such expenditure economically.

Targeting

Unlike the impacts arising from the effective duopoly in Victoria (PC 1999), there seems to be little evidence of rational or co-ordinated behaviour by the industry in the placement of machines in NSW. Presumably this is because the profits are so high that there is little incentive to maximise them. It appears that the most likely strategy is that existing venues are obtaining additional machines, or that they are acquiring additional premises so that they can transfer machines or acquire additional machines and keep under the venue-based cap.

Conclusion

In the current regulatory environment, the best strategy to maximise the benefits and to minimise the harm associated with gaming machines would be to approve those applications which are for machines in areas of high SEIFA index, with high average profit per machine and low existing density of gaming machines. Similarly, the preliminary findings of this study indicate that applications for areas with low SEIFA index and higher than average per adult expenditure should be rejected, and more active steps taken to limit and reduce access to EGMs in these areas.

In comparison, the largest harm is likely to be caused from the introduction of gaming machines in areas that are poor and currently have low densities of machines. In accordance with state-based caps, the limited number of new licenses available need to be generally directed away from these types of areas as a matter of policy. A more proactive strategy to limit access to these areas may well be required, including consideration of differential area-based caps, and a more comprehensive machine reduction strategy.

Overall, this study strongly indicates that restricting access to gaming machines in the ways noted above may well be the most effective harm minimsation strategy available at present. Further, careful monitoring of the cumulative impacts of the concentration of gaming machines in certain locations over time is vital in evaluating the efficacy of relying on state-government or venue based caps. Given the absence of regional or locality-based caps, and the propensity for the industry to transfer existing licences between venues, it may well be that one of the most effective mechanism for harm minimsation currently open to the NSW State Government is the rigorous SIA process currently in place.

However, the study indicates that access is one of the most crucial factors in increasing or diminishing gaming related harm. Given the increases in gaming revenue identified relative to EGMs (particularly in particular local communities), it is highly likely that there has been an increase in both the proportion of the population who are problem gamblers and their average per capita expenditure. This would indicate that current harm minimisation measures, including mandatory shut downs and more stringent technical standards for EGS, may not be as effective as hoped. In the final analysis, it is likely that the only effective harm minimsation measure would be a significant reduction in EGMs, particularly in more disadvantaged areas.

APPENDIX A

SUMMARY OF RESULTS OF CORRELATIONS

Table 1: Summary of Results of Correlations:
Values of R^2

	96/97 Average Profit per GM	(LOG) 96/97 Average Profit per GM	People per GM 1996	(LOG) People per GM 1996	$'s spent per Adult 1996	(LOG) $'s spent per Adult 1996	01/02 Average Profit per GM	(LOG) 01/02 Average Profit per GM	People per GM 2001	(LOG) People per GM 2001	$'s spent per Adult 2001	(LOG) $'s spent per Adult 2001	SIEFA	% Increase in GM's	% Increase in Profit	% Increase in Average Profit per GM	% Increase in People per GM	% Increase in $'s spent per Adult
96/97 Average Profit per GM	X		0.02	0.001	0.08	0.33	0.76						0.04	0.02			0.02	0.12
(LOG) 96/97 Average Profit per GM		X	0.10	0.04	0.10	0.55							.01	0.004				0.32
People per GM 1996	0.02	0.10	X		0.07	0.50			0.88				0.12	0.12			0.04	0.45
(LOG) People per GM 1996	0.001	0.04		X	0.46	0.64							0.20	0.22			0.22	0.26
$'s spent per Adult 1996	0.08	0.10	0.07	0.46	X						0.96		0.007	0.03			0.19	0.05
(LOG)	0.33	0.55	0.50	0.64		X							0.06	0.08			0.07	

$'s spent per Adult 1996																			
01/02 Average Profit per GM	0.76						X		0.001	0.006	0.13	0.27	0.10	0.02					
(LOG) 01/02 Average Profit per GM								X	0.006	0.0006	0.14	0.34	0.08	0.02					
People per GM 2001			0.88				0.001	0.006	X		0.08	0.48	0.16						
(LOG) People per GM 2001							0.006	0.0006		X	0.42	0.63	0.24						
$'s spent per Adult 2001					0.96		0.13	0.14	0.08	0.42	X		0.007						
(LOG) $'s spent							0.27	0.34	0.48	0.63		X	0.05						

per Adult 2001																		
SIEFA	0.04	0.01	0.12	0.20	0.007	0.06	0.10	0.08	0.16	0.24	0.007	0.05	X	0.01	0.01	0.02	0.001	0.01
% Increase in GM's	0.02	0.004	0.12	0.22	0.03	0.08	0.02	0.02					0.01	X	0.21			
% Increase in Profit													0.01	0.21	X			
% Increase in Average Profit per GM													0.02			X		
% Increase in People per GM	0.02		0.04	0.22	0.19	0.07							0.005				X	
% Increase in $'s spent per Adult	0.12	0.32	0.45	0.26	0.05								0.01					X

[i] The Productivity Commission[i] Inquiry Report outlines two models, which may be used to predict the increase in problem gamblers resulting from a specific increase in gaming machines. One model (the log model) predicts that for every 10 per cent increase in the number of gaming machines in an area, there would be a 7.4% increase in the number of new problem gambling clients. The other (the linear model) suggests that this effect varies, depending on the current density of machines – "with the effect at around 7.5 per cent (for every 10 per cent increase in machines) when machine densities are low, and around 9.4 per cent when machine densities are high" (PC 1999).

[ii] The Act establishes a two-tiered Social Impact Assessment process, ie Class 1 and Class 2. Class 1 SIAs provide basic information and are subject to less stringent assessment, and are to be prepared where the application relates to: an increase in four or less EGMs in a 3 year period, a transfer of gaming entitlements from another premises located within 1 kilometre, or a new club or hotel being removed to premises within 1 kilometre where there is no increase in EGMs. Class 2 applications apply to all other applications (eg where the application is for more than 4 EGMs), and is subject to the stringent SIA test and provisions outlined in this paper.

[iii] Under current legislation, there is a cap of 104,000 EGMs in NSW – 25,980 fro hotels and 78,020 for registered clubs. There are no regional caps in place as there are in Victoria.

[iv] This includes a provision that allows a trade in of each 3 AADs for 1 Poker Machine as an automatic entitlement. Given the much greater profitability of AADs, this means that there is considerable latitude for increasing profits without on the face of it altering the absolute number of EGMs through exchanging all existing AADs for Poker Machines over time.

[v] These requirements have been further refined by amendments to the NSW Gaming Machine 2001 (i.e. Amendment No. 3 in December 2002), principally the definition of 'local community' under the Act.

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