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## D Scoring in the Canadian Problem Gambling Index

### Key points

- Some Australian jurisdictions have used a modified version of the Canadian Problem Gambling Index, with concerns that this may significantly affect estimated prevalence rates.
- Using a range of plausible assumptions and simulation analysis, it is likely that using the amended CPGI:
  - underestimates the number of problem gamblers. It is not likely that the effect is more than a few per cent
  - overestimates the numbers of moderate risk gamblers to a more significant degree. The effect could readily be around 5 per cent
  - has ambiguous effects on the numbers of low risk gamblers
  - underestimates the number of no risk adults, but by a negligible degree.

As noted in chapter 5 and by Jackson et al. (2009), several Australian jurisdictions have altered the major contemporary instrument — the Canadian Problem Gambling Index (CPGI) for testing the extent of gambling risks in the population. The standard CPGI screen developed by Harold Wynne in Canada recommended a four-way classification of the frequency of problematic behaviours, with a scoring method of never=0, sometimes=1, most of the time=2, and almost always=3. But many Australian jurisdictions have introduced a new category, ‘rarely’, and altered the name of ‘almost always’ to ‘always’, with scoring of never=0, rarely=1, sometimes=1, often=2, and always=3.

Harold Wynne points out that changes to the screen may have changed its psychometric properties and, therefore, the interpretation of the prevalence estimates that result from the use of the screen. The critical policy question is the impact of this significant conceptual amendment on the measured risks from gambling. The effects can be tested empirically by making assumptions about what people answering the amended screen would have done had they answered the original screen (that is, different assumptions about ‘decision rules’).

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## D.1 What decision rules are credible?

The Likert items used in both versions of the CPGI correspond to subjective probabilities of certain states. Accordingly, taken literally, ‘never’ would mean a zero probability of some state (like feeling guilty) and ‘always’ would mean a 100 per cent of that state. In fact, people tend to use these terms in a more fuzzy way, so that ‘never’ might, in certain contexts, include things that happen once a year and ‘always’ might include things that happen *nearly* all the time. How people translate their beliefs about probabilities depends on the number of Likert items and also their labels, with a plausible representation of how each version of the CPGI corresponds to probabilities set out in figure D.1.

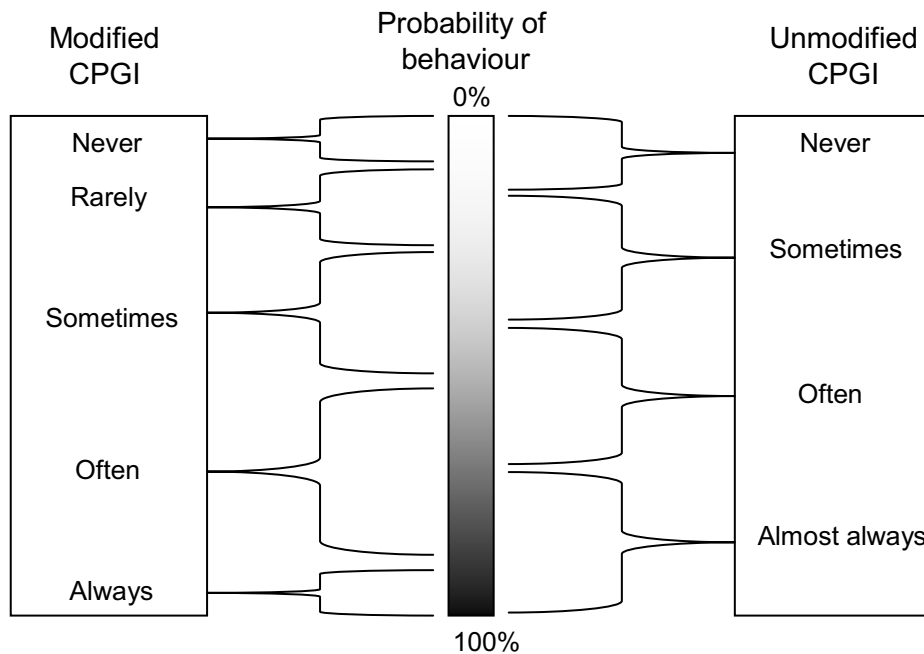
For each scale item in the modified screen, some assumption must be made about whether a respondent would be likely to choose some corresponding item on the unmodified CPGI scale, had that been presented.

- From one perspective, someone who does something ‘rarely’ (score of 1 under the amended CPGI), still does it ‘sometimes’ (also a score of 1 under the original CPGI). In that case, the introduction of ‘rarely’ would not alter CPGI results (since both score 1). However, as Harold Wynne argued in a personal communication to the Commission, an alternative view is that some people answering ‘rarely’ would have, in fact, considered the frequency so low that ‘never’ (score of 0) was a more appropriate response than ‘sometimes’. So it might be expected that a small proportion of people ( $\beta$ ) answering ‘rarely’ under the amended screen would have answered ‘never’ had they been asked the unmodified screen. This would tend to give higher scores on the modified CPGI.
- It can be expected that a proportion of people who do something ‘very frequently’, but not always, will choose ‘often’ under the modified CPGI, but would have selected ‘almost always’ under the unmodified CPGI. This would tend to give lower scores on the modified CPGI.
- The addition of ‘rarely’ in the modified scale would be likely to partly displace the item ‘sometimes’ so that it covers higher probability events than the corresponding item ‘sometimes’ in the unmodified scale (figure D.1). Consequently, it can be expected that some people answering ‘sometimes’ on the modified scale would have answered ‘often’ on the unmodified scale. Again, this would tend to give lower scores on the modified CPGI.

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Figure D.1 **The different scales of the instruments correspond to different probabilities**

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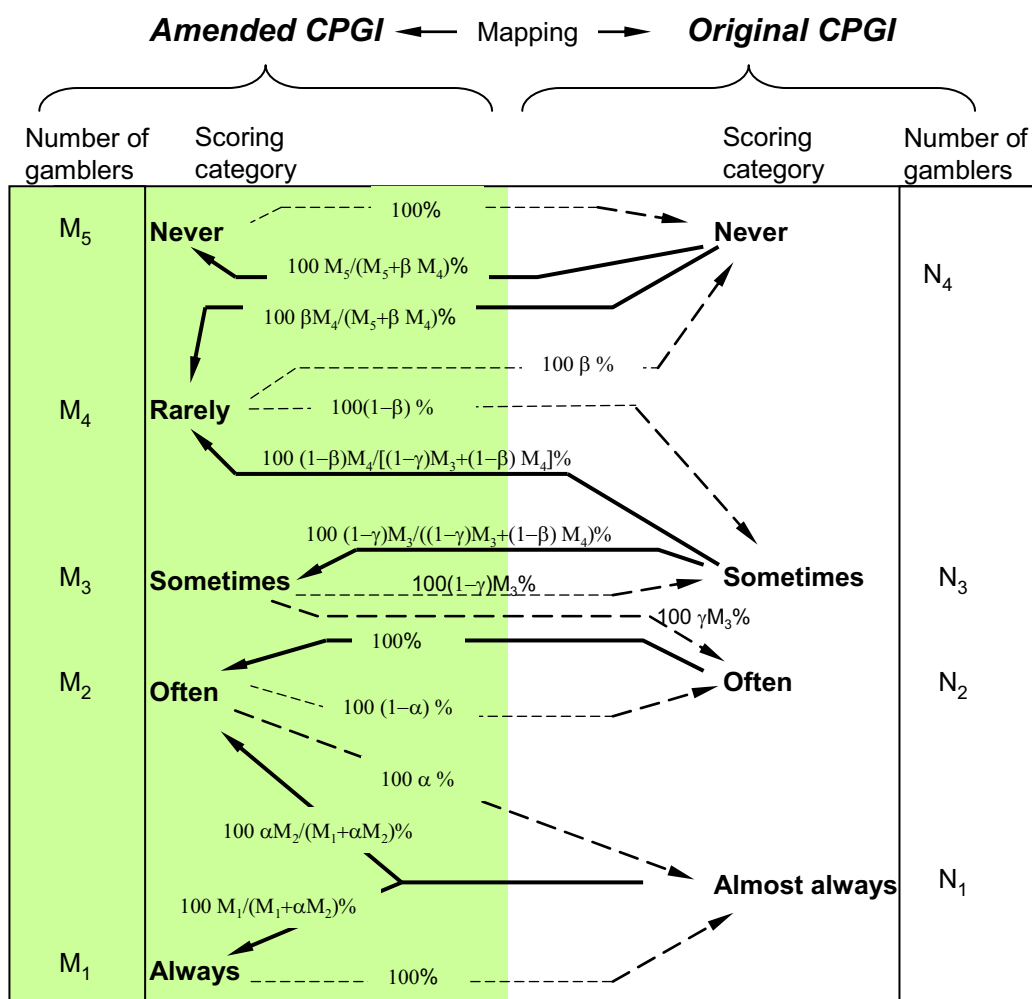
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Figure D.2 shows the implications of decision rules in which:

- there is a share of respondents ( $\beta$ ) answering ‘rarely’ to questions from the new screen who would have answered ‘never’ to questions from the original screen
- there is a share of respondents ( $\alpha$ ) answering ‘often’ to questions from the new screen who would have answered ‘almost always’ to questions from the original screen
- there is a share of respondents ( $\gamma$ ) answering ‘sometimes’ to questions from the new screen who would have answered ‘often’ to questions from the original screen.

The Commission considered the effects of a variety of decision rules on measured prevalence rates. The decision rules were selected so that the mapping in both directions between the original and the new CPGI resulted in outcomes that were plausible for each category (using the formulae shown in figure D.1). For example, using  $\alpha=0.5$  when analysing the NSW prevalence data would imply that the number of occasions respondents answered ‘often’ to questions in the original measure would be less than one-third of the number of occasions such respondents answered ‘almost always’ — which seems unlikely. Consequently, the Commission selected values for  $\alpha$ ,  $\beta$  and  $\gamma$  that did not lead to incongruous impacts on the numbers of people in each risk category.

Figure D.2 The links between the original and amended CPGI



## D.2 Some complexities in estimating the impacts of scale modification

Testing the impacts of any given set of decision rules is complex. For instance, one decision rule could be that two in three people answering ‘rarely’ (a score of one) would have answered ‘sometimes’ (also a score of one) under the original screen, but that one in three would have answered ‘never’ (a score of zero). That clearly reduces the aggregate CPGI scores, but its actual effects on the number of people in the no risk, low risk, moderate risk and problem gambling categories is not clear, but depends on how individual respondents answered all of the CPGI questions. To give some examples:

- Consider a person tested using the amended CPGI who answered ‘always’ for three CPGI questions and ‘rarely’ for another question with a total score of ten,

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and therefore a classification as a problem gambler. Suppose that this person was one of the three who would have answered ‘never’ instead of ‘rarely’ had the original test been used. Their score on the one relevant question would then be zero, but given the answers given to other questions, their classification as a problem gambler would not change.

- On the other hand, consider a person who was rated as a low risk gambler under the amended CPGI because they answered ‘rarely’ to one question. Suppose that it was this person, rather than the above one, who would have answered ‘never’ had the original CPGI been used. In that case, their classification would change from low risk to no risk.

Accordingly, different choices about *which* ‘one in three’ responses are changed from ‘rarely’ to ‘never’ makes a difference to the overall number of people identified in each risk category. Given this, it is not possible to accurately convert the scores from the amended CPGI to the original CPGI. However, for any given set of decision rules, it is possible to determine the likely average impact on prevalence rates and their confidence intervals by using Monte Carlo methods.

### D.3 Monte Carlo simulations

10 000 simulations were run to assess the impacts of the changes to the CPGI. In any single simulation, the following approach was adopted.

- For every question answered as ‘rarely’ for all CPGI questions and by all respondents, a random number (draw) was drawn from a uniform distribution between 0 and 1. If  $\text{draw} \leq \beta$  then the answer ‘rarely’ was demoted to ‘never’, and otherwise was rated as ‘sometimes’.
- Similarly, for every question answered ‘often’ for all CPGI questions and by all respondents, a random number was drawn from a uniform distribution between 0 and 1. If that  $\text{draw} \leq \alpha$  then the answer ‘often’ was promoted to ‘almost always’, and otherwise stayed at ‘often’.
- Likewise, for every question answered ‘sometimes’ for all CPGI questions and by all respondents, a random number was drawn from a uniform distribution between 0 and 1. If that  $\text{draw} \leq \gamma$  then the answer ‘sometimes’ was promoted to ‘often’, and otherwise stayed at ‘sometimes’.
- The conventional CPGI scoring of ‘never’=0, ‘sometimes’=1, ‘often’=2 and ‘almost always’=3 was then applied to all questions and respondents — and a total CPGI score for each respondent was calculated.

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- Each respondent was then given a risk rating from ‘no risk’ to ‘problem gambler’, based on their aggregate CPGI score.
  - Prevalence rates and numbers of people affected for each of the four risk groups were then calculated and recorded.

This set of calculations were undertaken 10 000 times, so that we ultimately had 10 000 observations for each of the four risk groups. The averages of these observations are estimates of prevalence that would have applied had the original CPGI test been used. They can be compared with the prevalence derived from the amended CPGI. The 10 000 observations can also be used to estimate the confidence levels of the above estimates.

In general, the simulation results (tables D.1 to D.3 applying to NSW, Queensland and South Australian CPGI data respectively) suggest that altering the CPGI scoring categories tends to underestimate the number of problem gamblers — as surmised by Harold Wynne — but the effect is small.<sup>1</sup> It is important to note that the percentage changes shown in the tables relate to the *numbers* of gamblers in each risk group, not the percentage points change in the prevalence rate. To place this in perspective, a 2.9 per cent increase in a prevalence rate of 0.95 per cent — the average bias in the NSW case — increases the prevalence rate to 0.98 per cent. That bias is trivial compared to other sources of uncertainty about the prevalence estimates. However, it should also be noted that there is a possibility that the bias is bigger than this. For example, were  $\beta=0.05$   $\alpha=0.30$   $\gamma=0.025$  then, given the confidence intervals shown in table D.1, there is a 5 per cent chance that the bias would be 12.9 per cent or more. In turn, that suggests the possibility that the prevalence rate could be  $1.129 \times 0.95 = 1.07$  per cent or more, a more significant measurement error.

The use of the amended CPGI also tends to *overestimate* the number of moderate and lower risk gamblers. This arises because there are more gamblers in these risk groups who answered ‘rarely’ on a CPGI item and fewer who answered ‘often’. Consequently, the likelihood of ‘demotion’ to a lower risk group is higher than the likelihood of ‘promotion’. The overall effect on the size of the low risk group depends on the numbers of gamblers demoted from the moderate-risk category compared with the numbers of people in the low-risk group demoted to the no-risk group. In the NSW dataset, the combined effect is that the numbers of low-risk gamblers rise after adjustment, while in the Queensland and South Australian datasets, numbers in both the moderate and low-risk groups fall somewhat.

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<sup>1</sup> In addition, the problem gambling prevalence rate is underestimated only in those studies (the bulk) where regular gamblers alone are asked the CPGI. There is a very small negative (average) effect for the Queensland survey.

**Table D.1 Conjectural impacts of the adapted CPGI on prevalence rates**

NSW prevalence data, 2006

Decision rule	Percentage change in the number of people in each risk category had the original CPGI been used <sup>a</sup>					
	No problem	Low risk	Moderate risk	Problem gamblers		
	%	%	%	Average %	5% cut-off %	95% cut-off %
$\beta=0.05 \alpha=0.10 \gamma=0.00$	0.8	0.9	-3.5	1.0	-2.2	4.7
$\beta=0.05 \alpha=0.10 \gamma=0.025$	0.7	0.2	-3.7	2.9	-1.0	8.5
$\beta=0.10 \alpha=0.10 \gamma=0.00$	1.6	1.7	-6.3	0.5	-3.2	4.7
$\beta=0.10 \alpha=0.10 \gamma=0.025$	1.6	1.1	-6.7	2.6	-2.2	8.5
$\beta=0.20 \alpha=0.10 \gamma=0.00$	3.2	2.7	-11.2	-0.3	-5.3	4.7
$\beta=0.20 \alpha=0.10 \gamma=0.025$	3.4	1.8	-11.6	1.5	-3.2	7.3
$\beta=0.05 \alpha=0.20 \gamma=0.00$	0.8	0.8	-4.2	2.4	-0.9	7.6
$\beta=0.05 \alpha=0.20 \gamma=0.025$	0.7	0.1	-4.5	4.5	0.0	10.7
$\beta=0.10 \alpha=0.20 \gamma=0.00$	1.6	1.5	-6.9	1.9	-3.2	7.3
$\beta=0.10 \alpha=0.20 \gamma=0.025$	1.6	0.8	-7.2	4.1	-1.3	10.1
$\beta=0.20 \alpha=0.20 \gamma=0.00$	3.2	2.6	-12.0	1.1	-3.2	7.3
$\beta=0.20 \alpha=0.20 \gamma=0.025$	3.3	1.8	-12.2	2.9	-3.2	9.4
$\beta=0.05 \alpha=0.30 \gamma=0.00$	0.8	0.6	-4.9	4.1	0.0	10.7
$\beta=0.05 \alpha=0.30 \gamma=0.025$	0.8	0.0	-5.3	6.1	0.0	12.9
$\beta=0.10 \alpha=0.30 \gamma=0.00$	1.5	1.5	-7.7	3.7	-2.2	9.8
$\beta=0.10 \alpha=0.30 \gamma=0.025$	1.6	0.8	-8.0	5.6	0.0	12.9
$\beta=0.20 \alpha=0.30 \gamma=0.00$	3.3	2.6	-12.8	2.4	-3.2	8.5
$\beta=0.20 \alpha=0.30 \gamma=0.025$	3.3	1.6	-12.8	4.5	-2.2	11.1
Mean of the means	1.9	1.3	-7.9	2.9	-2.0	8.7

<sup>a</sup> Based on 10 000 simulations for each decision rule. Data are the percentage *differences* between the simulated score (which is intended to proxy the result that would have occurred had the original screen been applied) and the actual CPGI score from the survey. For example, were  $\beta=0.05$ ,  $\alpha=0.3$  and  $\gamma=0$ , then the likely effect of using the original screen would be a 4.1 per cent increase in the number of problem gamblers. The 5% lower and 95% higher cut-offs describe the 90 per cent confidence interval for the problem gambling rate. Accordingly, for the decision rule example above, there is a 90 per cent likelihood that the problem gambling rate would have been between no higher and 11 per cent higher. The results for those with no problems include people who did not gamble or gamble frequently enough to be tested using the CPGI.

Source: PC calculations.

**Table D.2 Conjectural impacts of the adapted CPGI on prevalence rates**

Queensland prevalence data, 2006-07

Decision rule	Percentage change in numbers of people in each risk category had the original CPGI been used <sup>a</sup>					
	No problem	Low risk	Moderate risk	Problem gambler		
	%	%	%	Average %	5% cut-off %	95% cut-off %
$\beta= 0.05 \alpha= 0.10 \gamma= 0.00$	0.2	-1.7	-2.0	-1.4	-6.1	2.7
$\beta= 0.05 \alpha= 0.10 \gamma= 0.025$	0.2	-2.3	-1.1	2.2	-3.1	7.8
$\beta= 0.10 \alpha= 0.10 \gamma= 0.00$	0.4	-3.2	-4.1	-3.9	-9.0	1.2
$\beta= 0.10 \alpha= 0.10 \gamma= 0.025$	0.4	-3.9	-3.3	-0.3	-6.4	5.7
$\beta= 0.20 \alpha= 0.10 \gamma= 0.00$	0.9	-6.7	-8.5	-8.2	-13.4	-3.3
$\beta= 0.20 \alpha= 0.10 \gamma= 0.025$	0.9	-7.3	-7.6	-4.8	-10.7	1.8
$\beta= 0.05 \alpha= 0.20 \gamma= 0.00$	0.2	-1.8	-2.1	0.3	-4.7	4.8
$\beta= 0.05 \alpha= 0.20 \gamma= 0.025$	0.2	-2.4	-1.0	3.7	-2.0	9.5
$\beta= 0.10 \alpha= 0.20 \gamma= 0.00$	0.4	-3.5	-4.0	-2.3	-7.4	2.9
$\beta= 0.10 \alpha= 0.20 \gamma= 0.025$	0.4	-4.0	-3.2	1.3	-5.1	7.8
$\beta= 0.20 \alpha= 0.20 \gamma= 0.00$	0.9	-6.8	-8.4	-6.7	-12.2	-1.2
$\beta= 0.20 \alpha= 0.20 \gamma= 0.025$	0.9	-7.4	-7.6	-2.9	-8.9	3.8
$\beta= 0.05 \alpha= 0.30 \gamma= 0.00$	0.2	-2.0	-2.0	1.8	-3.6	6.6
$\beta= 0.05 \alpha= 0.30 \gamma= 0.025$	0.2	-2.5	-1.1	5.5	-0.9	11.4
$\beta= 0.10 \alpha= 0.30 \gamma= 0.00$	0.4	-3.6	-4.1	-0.8	-6.7	4.8
$\beta= 0.10 \alpha= 0.30 \gamma= 0.025$	0.4	-4.1	-3.2	2.8	-3.9	9.7
$\beta= 0.20 \alpha= 0.30 \gamma= 0.00$	0.9	-7.0	-8.5	-4.9	-10.8	1.0
$\beta= 0.20 \alpha= 0.30 \gamma= 0.025$	0.9	-7.6	-7.4	-1.8	-8.6	5.2
Mean of the means	0.5	-4.3	-4.4	-1.1	-6.9	4.6

<sup>a</sup> Unlike the NSW and South Australian surveys, the CPGI was implemented for all gamblers in Queensland, not just 'frequent' ones. This is probably why the effects found for this dataset are somewhat different from those found in those jurisdictions. In particular, non-frequent gamblers are much more likely to have ticked 'rarely' for an item, and so the likelihood of 'demotion' is greater for these groups. Since non-frequent gamblers are the most common ones, the overall effect is that all risk categories (CPGI 1+) show average reductions in numbers — albeit small ones.

Source: PC calculations.

**Table D.3 Conjectural impacts of the adapted CPGI on prevalence rates**

South Australian prevalence data, 2005

Decision rule	Percentage change in numbers of people in each risk category had the original CPGI been used <sup>a</sup>					
	No problem	Low risk	Moderate risk	Problem gambler		
	%	%	%	Average %	5% cut-off %	95% cut-off %
$\beta=0.05 \alpha=0.10 \gamma=0.00$	0.5	-1.0	-1.4	0.0	-4.1	4.1
$\beta=0.05 \alpha=0.10 \gamma=0.025$	0.4	-2.0	-1.0	2.7	-2.7	8.1
$\beta=0.10 \alpha=0.10 \gamma=0.00$	1.0	-2.2	-2.9	-1.4	-6.8	2.7
$\beta=0.10 \alpha=0.10 \gamma=0.025$	0.9	-3.0	-2.4	0.0	-5.4	5.4
$\beta=0.20 \alpha=0.10 \gamma=0.00$	1.9	-4.2	-6.3	-5.4	-10.8	0.0
$\beta=0.20 \alpha=0.10 \gamma=0.025$	1.9	-5.0	-5.8	-2.7	-8.1	2.7
$\beta=0.05 \alpha=0.20 \gamma=0.00$	0.5	-1.2	-1.9	1.4	-2.7	5.4
$\beta=0.05 \alpha=0.20 \gamma=0.025$	0.5	-2.0	-1.0	4.1	-1.4	9.5
$\beta=0.10 \alpha=0.20 \gamma=0.00$	0.9	-2.2	-3.4	0.0	-5.4	4.1
$\beta=0.10 \alpha=0.20 \gamma=0.025$	0.9	-3.0	-2.4	1.4	-4.1	8.1
$\beta=0.20 \alpha=0.20 \gamma=0.00$	1.9	-4.5	-6.8	-4.1	-9.5	1.4
$\beta=0.20 \alpha=0.20 \gamma=0.025$	1.9	-5.2	-5.8	-1.4	-6.8	4.1
$\beta=0.05 \alpha=0.30 \gamma=0.00$	0.5	-1.2	-1.9	2.7	-1.4	6.8
$\beta=0.05 \alpha=0.30 \gamma=0.025$	0.5	-2.2	-1.4	5.4	0.0	10.8
$\beta=0.10 \alpha=0.30 \gamma=0.00$	0.9	-2.5	-3.9	1.4	-4.1	6.8
$\beta=0.10 \alpha=0.30 \gamma=0.025$	0.9	-3.2	-2.9	2.7	-2.7	9.5
$\beta=0.20 \alpha=0.30 \gamma=0.00$	1.9	-4.5	-6.8	-2.7	-8.1	4.1
$\beta=0.20 \alpha=0.30 \gamma=0.025$	1.9	-5.5	-5.8	0.0	-5.4	6.8
Mean of the means	1.1	-3.0	-3.5	0.2	-5.0	5.6

<sup>a</sup>The CPGI was implemented for frequent gamblers only. The results for those with no problems include people who did not gamble or gamble frequently enough to be tested using the CPGI.

Source: PC calculations.