INFOMETRICS

Comments on

the Commerce Commission's Draft Determination on the NZRU's Application Regarding the NPC Competition

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I have been asked by the NZRU to address the following issues:

1. Owen and Weatherston's econometric analysis of the role of the Uncertainty of Outcome Hypothesis in determining spectator attendance at NPC matches.

2. The Commission's econometric analysis of the same hypothesis.

3. The Commission's calculation of spectator enjoyment public benefits.

I have had access to the following documents:

- Commerce Commission (2006), *Draft Determination,* 9 March (public version).

- Copeland, M.C. (2005), *Economic Analysis of Competitive Detriments and Public Benefits of Proposed Arrangements between the New Zealand Rugby Union and Provincial Unions to Create More Competitive Domestic Competitions,* 8 November, (confidential version).

- Copeland, M.C. (2006), *NZRU Application to Commerce Commission: Notes on Owen And Weatherston Papers Regarding the Determinants of Match Attendance*, 21 February.

- Fort, R. (2006), Comments on Owen and Weatherston, 17 February.

- Owen, P.D. & C. R. Weatherston (2002), *Uncertainty of Outcome and Super 12 Rugby Union Attendance: Application of a General-to-Specific Modelling Strategy,* Paper presented at NZAE Annual Conference, Wellington, June.

- Owen, P.D. & C. R. Weatherston (2004)," Uncertainty of Outcome, Player Quality and Attendance at National Provincial Championship Rugby Union Matches: an Evaluation in Light of Competitions Review," *University of Otago Discussion Paper* No 0408.

I have also had access to the database used by the Commerce Commission for their modelling. In addition I am aware that Mr Copeland has prepared a report in response to the Draft Determination, but I have not sighted it.

Owen and Weatherston

One of the first lessons that an econometrics student is taught is that 'just because one can't identify a relationship doesn't mean that it doesn't exist.' This is likely to be the case with regard to OW's claim that game uncertainty does not affect match attendance; contrary to the Uncertainty of Outcome Hypothesis. There are a number of reasons for this.

1. OW use the TAB odds as a proxy for game uncertainty. They are not a good proxy as they do not actually measure game uncertainty as perceived by an individual. The odds just measure the balance of wagers which in aggregate may be a reasonable pointer to the team that is more likely to win, but enough perceived uncertainty usually remains for match results to go either way. People still attend if they believe that their team has a reasonable chance of wining, albeit against TAB odds.

2. From econometric theory it is well known that variables that exhibit little variation – such as TAB odds for most NPC games – are unlikely to yield strongly significant coefficients. It would be interesting to see a repetition of OW's analysis once weaker teams such as Manawatu and Tasman have joined the competition.

3. OW do not consider inter-seasonal uncertainty. Arguably this might be subsumed into the TAB odds, but that would make them even a poorer proxy for match uncertainty. The Commission uses better proxies for uncertainty of different types (although some other issues then arise, as discussed below).

4. The semi-automatic methodology by which OW reach their preferred models does not seem to deal with the potential problem of autocorrelation. Indeed no statistics relating to autocorrelation are even reported. Autocorrelation can arise when potentially important variables are omitted (OW's model does not contain ticket prices) or when model errors are correlated between periods, such as if match attendances respond with a lag to team performance. OW include a lagged dependent variable in their models, which they justify by appealing to habit persistence. It is entirely possible, however, that it is capturing the lagged effects of uncertainty. People's expectations of match outcomes are likely to persist for more than a season. Expectations take time to change even if a run of unexpected (good or bad) results occurs. This gives rise to another problem in OW, multicollinearity.

5. Multicollinearity occurs where a number of explanatory variables are highly correlated with each other. OW use dummy variables such as for matches between traditional rivals, but this may in fact be picking up a balanced teams effect – for example Auckland and Canterbury. The Wellington dummy also does this, though it undoubtedly captures pure stadium effects as well. Likewise for geographic proximity. With these variables all capturing at least some element of match unpredictability, the power of variables such as TAB odds to explain uncertainty is further undermined.

6. The dataset used by OW in both of their papers has many games, but over a compressed time dimension. This makes it impossible to statistically test for the presence of non-stationary series (those with an increasing variance over time), but it does not remove the possibility of spurious coefficients arising through the presence of common trends, such as between rising attendance and rising earnings perhaps. The methodology use by OW does not address this issue and may lead to the presence of such effects forcing out explanatory variables with greater theoretical relevance.

In summary, OW's analysis does not support the inference that match attendance is not affected by uncertainty of outcome.

Draft Determination

Crowd Attendance Model – multicollinearity
The model presented by the Commission in paragraphs 627-628 and in Appendix 2 delivers an R^2 of around 35% which is a reasonable result for a cross-section analysis. Nevertheless it still leaves considerable room for other explanatory factors which presumably are not all random factors such as weather or simultaneous competing attractions.

The model also contains some innovative measures of outcome uncertainty. As with OW's analysis, however, the estimated coefficients are probably affected by multicollinearity, leading to weak measures of statistical significance.

1. There are two measures of outcome uncertainty, in the form of A*B and A*A, where A is a measure of the difference between trend and ideal win rates, and B is a measure of the difference between current and trend win rates. If stronger teams have been becoming stronger and weaker teams becoming weaker, the two measures will be correlated.

2. The dummy variable for the probability of reaching a semi-final (*semip*) would also capture uncertainty if semi-finals are between relatively evenly matched teams – which is usually the case.

3. There may also be some correlation between *semip* and market size.

With this degree of multicollinearity it is somewhat surprising that one of the uncertainty measures *uncert* (which is the A*B variable) is nonetheless reasonably significant (p-value = 0.08) and has the expected negative sign. Hence a combination of average uncertainty and marginal uncertainty statistically dominates a simple average measure (bearing in mind the likely correlation). This is an interesting result when compared to Owen and Weatherston's finding that TAB odds, which presumably reflect both average and marginal expectations about game outcomes, are statistically insignificant in explaining attendance. Given the multicollinearity, the Commission has been rather hasty in dismissing the significance of this result; that is, it has undervalued the relevance of the Uncertainty of Outcome Hypothesis. It would be interesting to see the statistical significance of *uncert* without the other uncertainty variable(s) being present.

Spectator Enjoyment Public Benefits – effective ticket price
With regard to the model in Appendix 3, the cost of attending a game is not just the ticket price (or an implicit share of a season ticket). For most people transport to and from the venue, plus parking charges, raise the cost of attending a game. Thus the average ticket price of $15 is likely to be an underestimate of the effective attendance price faced by spectators. By itself this does not affect the estimated coefficient on price. However, a higher average price for a given number of spectators raises the value of the intercept term in the demand equation (Equation 2 in Appendix 3). This means that for any given increase in spectator numbers as in Table 15 (para 665), the net increase in public benefits will be larger than estimated by the Commission.[1]

For example, an average effective attendance price of $17 would raise the public benefit in say the 10% scenario from $42,249 to around $46,800. An average effective price of $20 implies a public benefit of over $55,000.

Spectator Enjoyment Public Benefits – number of spectators
The definition of quantity (Q) in Appendix 3 seems to be the average aggregate attendance per union per season, although the explanatory footnote refers simply to aggregate annual attendance. The value of the intercept (*a_hat*) in the equation is 74,724, which applies when the price is zero, so point Q_1 in Figure 5 (para 655) must be less than 74,724. I estimate Q_1 is approximately 38,500. This is an order of magnitude too low to be aggregate attendance over all unions in a season. The NZRU informs me that the average NPC Division 1 crowd attendance over the period 2002 to 2004 was 12,470 and there were 48 games per season. Hence an average annual aggregate attendance of 598,560. Therefore the public benefits estimated in Table 15 (para 665) are also an order of

[1] I have been able to replicate Table 15 to within about 2%. The difference is probably due to rounding or details of the discounting process.

magnitude too low. That is, instead of a public benefit under the 10% scenario of $42,249 (Table 15), the public benefit would be over $600,000. There is a direct linear relationship between the number of spectators and the public benefit.

As a check on this, it is easily calculated from the data in Table 15 that the gain in consumer surplus in Figure 5 is about $23,600 for the 10% scenario. To arrive at a gain per spectator of $0.52 as reported in Table 16, the number of spectators must be about 45,500. However, this is too low – again by an order of magnitude – to be the total number of spectators over all unions, over a whole season.

Conclusion

Three main conclusions may be drawn from the above.

1. The evidence that the Commerce Commission presents in its Draft Determination against the Uncertainty of Outcome Hypothesis is not robust.
2. The total cost of attending a match exceeds the ticket price, implying that spectator enjoyment public benefits from the Proposed Arrangements have been under-estimated.
3. In addition, the Commission appears to have miscalculated the spectator enjoyment public benefits by an order of magnitude because it has incorrectly used the average annual aggregate attendance per union instead of the average annual aggregate attendance for all ten unions that were in the NPC Division 1.

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