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Virginie Masson, Nicholas Sim, and Luke Wedding

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Virginie Masson†, Nicholas Sim and Luke Wedding

School of Economics, University of Adelaide SA 5005

Abstract

In this paper, we investigate whether the Australian Football League (AFL) intervention policies coincided with a more even-playing field in the league, as captured by individual match margins. We find that only two out of the eight major policies implemented over the last hundred years are correlated with lower margin. All other policies are at best ineffectual, and at worst, potentially damaging to the evenness the AFL strives to achieve.

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Keywords: Australian Football League (AFL), Sports Economics, Equalisation Policy, Competitive Balance, Econometric Analysis

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†Corresponding author. School of Economics, University of Adelaide, Adelaide SA 5000, Australia; E-mail: `virginie.masson@adelaide.edu.au`.

1 Introduction

Australia rules football is arguably the most popular spectator sport in Australia and is firmly entrenched in Australian culture through music, literature, film and television. The highest level of professional competition is coordinated by the Australian Football League (AFL) (Victorian Football League or VFL until 1989), which has a history of policy interventions aimed at increasing competitiveness. These interventions, e.g. metropolitan zoning introduced in 1915, are known as equalisation policies.

Over the last one hundred years, eight major interventions have been implemented. While the earlier interventions seem to have been effective in keeping match margins in check, the policies implemented more recently have not been as successful in reining in the growing imbalance in the league. In fact, there is an ongoing debate on ways to restore parity and competitiveness in the league, as doubts had grown regarding the actual efficacy of the existing policies.[3] To engage this discussion in a constructive manner, it is important to first identify which policy or policies were responsible for undoing the equalisation objectives of the AFL. Without undertaking an econometric analysis, it would be difficult to distinguish objectively between policies that are effective from those that are not.

In this paper, we explore the effectiveness of the AFL's intervention policies throughout the years in achieving their intended aim of an even-playing field. The purpose of this paper is not to answer why certain policies had been less successful than others in achieving competitiveness in the league. Rather, our aim is to clarify which policies had been more effective than others by letting the data "speak" for itself. To capture the notion of competitiveness, we consider the margin of each individual match from 1897 to 2009 (Lienert (2013)).[4] Utilising three different classes of estimation approaches – ordinary least squares

[3] In March 2013, the governing body of the AFL (the AFL Commission) met with club presidents to discuss the future of the AFL equalisation objective. See, for example, "AFL Commission Meeting with Club Presidents / Chairman - Equalisation", `http://www.afl.com.au/news/2013-03-20/afl-commission-meeting-with-club-presidents-chairman-equalisation.`

[4] This also follows from the suggestion of current AFL Chairman Mike Fitzpatrick that the equalisation

regression, ordered probit regression, and asymmetric least squares regression – to ensure our findings are robust, we conduct a qualitative (non-causal) econometric analysis to examine the variation of match margins that can be attributed to the policy or policies in place.[5] We found that only two policies, one which specifies a minimum spending amount on players' wages and one which allows poor performing teams to pick new talent ahead of other teams, coincide with relatively lower match margins. However, other policies related to zoning, revenue sharing, salary cap, largely counter-balance this positive result.

Although closely related to Booth (2004), our analysis differs in two aspects. First, Booth uses the concept of competitive balance at the seasonal level[6] to capture the evenness of the competition, while we focus on match-level data. Second, his conclusions are drawn from the observed variations of competitive balance in relation to the intervention policies in place, without further statistical analysis. Our approach relies heavily on statistical analysis and involves three different methods of estimation to ensure that our results are not artefacts of model choice. To the best of our knowledge, our paper is the first to conduct an econometric analysis on the issue of equalisation policy and competitive balance in the context of the AFL.

Rottenberg (1956) was the first to argue for the importance of uncertain outcomes in matches and the even distribution of talent in competitive leagues to maintain fans' interest. The literature that followed focused mainly on the relationship between competitive balance and match attendance,[7] or between intervention policies and the even distribution of talent. Unfortunately, in the latter case which is of interest to us, most studies involved profit maximising leagues, of which the AFL is not (Booth (2004)). Therefore, conclusions drawn

policy is aimed at ensuring any club is capable of winning any given match.

[5]We emphasize the non-causal nature of our analysis because it is not possible to identify the exogenous variation in each of the policy itself due to the lack of a "control group" or a suitable natural experiment.

[6]Competitive balance compares the actual dispersion of team win per cents with the ideal competitive dispersion where every team has a win per cent of 0.5.

[7]For a paper about match attendance in the AFL, see Lenten (2009)

from those studies should be treated carefully when applied to the AFL.

In a league with profit maximizing teams, salary caps are shown to improve competitive balance (Kesenne (2000)) and ensure an even distribution of talent (Fort and Quirk (1995) and Vrooman (1995)). However, equal gate revenue sharing promotes no change in the distribution of talent (Kesenne (2006)), and reverse-order draft has no impact due to the invariance proposition (Fort and Quirk (1995) and Vrooman (1995)).[8] Our findings differ and further highlight the differences between the AFL and profit-maximising leagues.

The paper is organised as follows. Section 2 introduces the AFL intervention policies and the reason for their implementations. Section 3 briefly describes the data used for this study and Section 4 describes the methodology used for the estimations of our models. Results are discussed in Section 5, robustness checks are presented in Section 6, and Section 7 concludes.

2 Equalisation Policy

In this section, we briefly describe the policies implemented by the VFL/AFL throughout its history, and provide, for each of them, a short historical background. These policies are reminiscent of those implemented in major US leagues to improve competitive balance (Sanderson and Siegfried (2003)). For a detailed account on the history of the VFL/AFL recruitment, transfer and payment rules, we refer the reader to Booth (1997).

2.1 Free Agency, Zoning and the Coulter Law

In their book, Sandercock and Turner (1981) provide some insights into the early AFL labour market. They reveal that although transfer fees and the payments of wages to players were essentially banned, clubs could go about hiring talent from wherever they wished, including fellow AFL clubs, so long as clearance was permitted by that player's club. This meant that

[8] The distribution of playing talent between clubs in professional sports leagues does not depend on the allocation of property rights to players' services.

there was a kind of "free agency" for playing talent (Booth (2004)). However, in the wake of clubs dealing players behind closed doors, the banning of payments to players was overturned in 1911 which meant that the league advanced from amateurship to professionalism.

In 1915, the league introduced a policy of metropolitan zoning, the first action taken in an attempt to improve competitive balance. Under this policy, each club was allocated a "zone" within metropolitan Victoria where they could select talent without worrying about their prospects being poached by other clubs. However, teams were still able to pursue talent from the country areas and interstate in the same unrestricted manner as before. The league maintained the status quo with regards to the talent market until 1930. Then, as the Great Depression affected football considerably and the VFL was concerned about "excessive payments", individual player payments were restricted to three pounds a match (Holmesby and Main (1996)); this was known as the Coulter Law.

In addition to metropolitan zoning, the policy of country zoning was added in 1968. Twelve zones were drawn up (for the twelve teams at the time) and randomly assigned to the teams, where they were only allowed to draw talent from their allocated zone.

2.2 Gate and Other League Revenue Sharing

Before World War Two, the home team kept all the gate revenue generated by fans coming to watch the game, thus unfairly giving advantage to the larger clubs, as explained in Booth (2006).

In 1945, the policy of gate revenue sharing was implemented, where gate revenues were split equally between the two competing teams after the deductions of match expenses (Booth (2006)). However, since clubs at smaller grounds with a large membership and low cash paying crowd gave very little to the visiting teams, the AFL abolished the 50-50 gate revenue sharing at the end of 1999.

In addition to gate revenue sharing, the league experimented other forms of revenue sharing. According to Booth (2006), the league implemented a surcharge on cash paying spectators which would go into a ground development fund in 1974. This meant that clubs who attracted more supporters on game day would be contributing more and so were burdened with a greater share. In the 1980s, additional league revenue sharing policies were used to equalise club finances. This includes the VFL equalisation fund in 1981, which was financed through a levy paid by spectators; a club development fund, in 1983, which also incorporated the ground development fund and was financed with a surcharge on spectator tickets. This fund was in 1986 incorporated to the VFL equalisation fund.

The equalisation fund was retained after the abolition of gate revenue sharing, and an annual special distribution fund was also set up with every club. It provided a base payment by the AFL to the clubs, with financially weaker clubs given more to stay financially strong.

2.3 Team Salary Cap and Total Player Payments

In 1985, a team salary cap was set up by the VFL with all clubs having to keep their squad wage bill below this cap. By imposing this limit on the amount clubs could spend on players' wages, the league aimed at promoting a more even distribution of talent amongst clubs and avoid the richest ones stockpiling the best talent.

From 1999, the team salary cap was incorporated into another policy known as Total Player Payments, which specifies both a minimum and a maximum amount a club must spend on players' wages after deducting allowances for relocation and living, testimonials, veterans, finals and injury payments.

2.4 Reverse-Order Draft

The first national league draft, a reverse-order draft, was held after the 1986 season. All young talent from around Australia hoping to be selected by a team would be subjected to the draft. The draft was split into rounds, with each team able to make one selection per round. The reverse order nature of the draft meant that teams selected in the reverse order of the position they finished on the league table. If a team finished bottom of the ladder they would get first selection in the draft and so on. The idea of this type of draft is that uncompetitive teams would be able to catch-up by being able to select from the best young talent in the country.

In 1993, priority draft picks were introduced whereby any club only able to obtain 20 points or less in the previous season got one priority draft selection before round 1. In 2006, amendments to the policy were implemented such as a new threshold - 16 points - and a different timing - after round 1 but before round 2. This means that in addition to their first round selection, eligible teams get to choose another player after all teams have selected in round 1 but before round 2 begins. Also, if a club obtains 16 points or less a season for two straight seasons, they are entitled to a priority draft selection before round 1. The priority pick system therefore makes the draft more powerful for aiding the talent catch-up for uncompetitive teams. This system has since be modified by the AFL in 2012 whereby priority picks are decided on a discretionary basis by the Commission.

3 Data Description

We assembled a raw dataset from official AFL historical statistics that contains the match margin for every game played from 1897 to the end of 2009.[9] Table 1 reports the summary statistics for match margin per season for the 13815 games played during this period.

To get of sense of how competitive the league has been across time, Figure 1 plots the average match margin per season during the sample period. It shows a clear upward trend

[9]The introduction of two news teams, Gold Coast and Greater Western Sydney, into the league saw the implementation of a number of significant policy exemptions which explains why the most recent years have been omitted.

after 1960 that is followed by another spike in 1980. Indeed, average match margins have been higher during the years that saw the implementation of more recent policies such as league revenue sharing and Total Player Payments. As Table 2 shows, the average match margin before 1968, during which metropolitan zoning, Coulter law, and gate revenue sharing were in force, meanders around the ballpark figure of 28 points. In contrast, the implementation of league revenue sharing from 1968 onwards has coincided with a much sharper increase in the average match margin (i.e. 33 points during 1968-1985). The average spread has widened further to 36 points despite the implementation of the latest AFL policies to date – team salary cap and reverse-order draft from 1985 and Total Player Payments from 1999 onwards.

4 Methodology

Before going into the details of our analysis, we want to emphasise that the positive relationship between the average match margin and equalisation policies by no means imply that the policies had caused match margins to worsen. The very fact that match margins were high could have prompted the use of these policies in return. It is thus difficult to disentangle the policy effects on match margins from the reverse causal effect that unfavourable margins have on decisions to put these policies in place. To capture the causal effects of equalisation policies on match margins, one would need to exploit a quasi-natural experiment that "approximately randomly" assigns these measures on some football leagues and not others. Clearly, since the AFL has no comparables, there is not even a control group that we can speak of, let alone worry about whether the actual equalisation measures are reasonably exogenous for identification to hold.

Therefore, we conduct a qualitative analysis that looks at the variation in match margins that can be attributed to each intervention policy, where each intervention is indicated by a binary variable (see below). This qualitative approach of examining the variance of the "dependent variable" of interest is commonly known in social sciences as the analysis of variance (ANOVA). To ensure that our results are not artefacts of model choice, we consider three estimation approaches.

First, we begin by considering an ordinary least squares regression of the linear model that relates match margin (*Margin*) to a vector of policy indicator variables (*Policy*) and a set of control variables (*Controls*) as

$$Margin_i = c + \boldsymbol{\delta}' Policy_i + \boldsymbol{\beta}' Controls_i + \epsilon. \tag{1}$$

where i is the match index. The policy vector contains eight policy indicator variables (references to them are italicized hereinafter) that are equal to 1 if they were implemented at the time of the match (in parenthesis):

1. *Metropolitan Zoning* (1915 to 1984);
2. *Coulter Law* (1930 to 1968);
3. *Gate Revenue Sharing* (1945 to 1999);
4. *Country Zoning* (1968 to 1986);
5. *League Revenue Sharing* (1974 to present);
6. *Salary Cap* (1985 to present);
7. *Draft* (1993 to present);
8. *Team Salary Floor* (1999 to present).

Besides *Team Salary Floor*, the rest of the policy indicator variables are self-explanatory. Because Total Player Payments incorporates the team salary cap, we chose to keep the team salary cap separate and instead create the variable *Team Salary Floor*, which captures the minimum spending on players' wages specified by Total Player Payments. Also, since the reverse-oder draft was included almost at the same time as the team salary cap, it is worth acknowledging that the variable *Salary Cap* does incorporate effects from the reverse order draft policy. However, the priority draft picks policy introduced in 1993 can clearly be separated and is captured by the variable *Draft*.

The set of control variables in (1) contain two additional indicators, *Finals* and *Struggling*, where *Finals* is equal to 1 if the match is a final[10] and *Struggling* is equal to 1 if the match is between a team in contention for the *Finals* and a team out of contention for the *Finals* from 1987 to present. Since the *Finals* are arguably the most important games in the season, one-sided *Finals* could prompt the introduction of measures to even out the competition. This implies that *Finals* could be correlated with both policies and match margins, hence is an important control variable from an econometric perspective. In addition to *Finals*, we include *Struggling* that is in force from 1987 onwards to partial out a possible perverse response of match margins that may follow from reverse-order draft. Specifically, *Struggling* teams could in principle secure a higher draft pick by performing badly when there is no chance of making the *Finals*. Without including *Struggling* as a control, the *Draft* policy indicator may capture this unwanted effect of priority draft pick on match margins, which perhaps is not representative of the general influence that this policy would have had on competitiveness throughout a season.

The use of ordinary least squares regression has one drawback: besides estimating the conditional mean, it does not provide information about the distribution of match margins which is what the intervention policies are meant to change. For instance, an intervention policy that effectively reduces match margins when they are already small but does little to close gaps that are large could not be deemed successful. Therefore, instead of focusing on

[10] A final is match between two of the home and away round top teams.

the conditional mean, it is important to look at the distributional effects of these policies as well.

For our second approach, we use an ordered probit model to estimate the relationship between the intervention policies and the probability of observing match margins within nominated intervals. We consider three match margin intervals: 0 to 12 points; 13 to 18 points; 19 to 24 points; and (strictly) over 24 points. The 0 to 12 points interval, representing a difference of two goals at most, captures a strongly even game. The subsequent intervals are obtained by sequentially adding one goal until the equivalent of four goals (24 points) is reached. If the intervention policies are effective, they would be associated with strong reductions in the probability of observing match margins that are 24 points or more, and less strongly related to the probability of observing narrow match margins.

Although useful, the ordered probit model may not be completely satisfactory as it requires choosing the boundaries of each interval in an ad-hoc manner. While the ordered probit model conveys some information about the distributional effects of the intervention policies, a more direct approach would be to estimate the conditional quantile of match margins based on

$$Margin_i(\tau) = c(\tau) + \boldsymbol{\delta}(\tau)'Policy_i + \boldsymbol{\beta}(\tau)'Controls_i + \epsilon_i(\tau), \tag{2}$$

where τ is a parameter between 0 and 1, $Margin(\tau)$ is the τ conditional quantile of match margin and $\epsilon(\tau)$ is an error term with its τ quantile normalised to zero. Equation (2) describes a rich but yet simple model for us to look at the distributional consequences of the intervention policies. For instance, to examine the link between these policies and large margins, we may choose $\tau = 0.9$ and look at the variation of the 90th percentile of margin margins that is associated with the policy measures. Likewise, with respect to small match margins, we may choose $\tau = 0.1$ to look at the variation of the 10th percentile of match margins that is policy related. Therefore, the relationship between the intervention policies and the distribution of match margins can be studied by choosing τ flexibly.

Usually, quantile regression would be the way for estimating conditional quantiles. However, it is unsuitable for our analysis as all our regressors are indicator variables. Because the quantile regression objective function is not strictly convex, having only dummy regressors increases the likelihood that the same conditional quantile is generated by a non-unique set of parameter values. Therefore, to overcome this issue of multiplicity, we used an alternative estimation strategy that mimics the estimation of conditional quantiles but uses a strictly convex objective function.

This methodology, which is our third estimation approach, is known as asymmetric least squares (ALS) regression. ALS regression, first proposed by Newey and Powell (1987), estimates the parameters of the model by minimising an asymmetric sum of squares criterion:

$$\min_{c_\theta, \mathbf{d}_\theta, \mathbf{b}_\theta} \sum_i w_i(\theta)(Margin_i - c_\theta - \mathbf{d}'_\theta Policy_i - \mathbf{b}'_\theta Controls_i)^2 \tag{3}$$

with $\theta \in (0, 1)$ and where the weight $w_i(\theta)$ is given by

$$w_i(\theta) = |\theta - \mathbb{I}(Margin_i < c_\theta + \mathbf{d}'_\theta Policy_i + \mathbf{b}'_\theta Controls_i)| \tag{4}$$

Unlike quantile regression that estimates the conditional quantile, ALS regression estimates a different object known as the conditional expectile. In particular, the linear conditional expectile tends to be a flatter function of θ than the linear conditional quantile is of τ (recall that θ and τ are both defined on the unit interval). Hence, the $\theta = 0.75$ (say) conditional expectile and the $\tau = 0.75$ conditional quantile of match margins are unlikely to be the same. Interestingly, however, we may still uncover the τ conditional quantile via

ALS regression. This is because for a given τ, the linear conditional expectile and quantile functions will cross at some specific value of θ such that at this θ, the θ conditional expectile is equal to the τ conditional quantile. As it turns out, by choosing θ such that τ proportion of data lies below the conditional expectile hyperplane,[11] an ALS regression based on this θ can be used to estimate the τ conditional quantile of match margins.[12]

5 Results and Discussion

In Table 2 of Section VIII, we have seen that the later intervention policies were associated with much higher match margins than the earlier policies were. However, cursory observation of this evidence does not provide a clear lead as to which of these policies are actually less or ineffective for helping to maintain competitiveness in the AFL. To decompose the variation of match margins that is associated with each of the intervention policies, we first appeal to OLS regression where our findings are presented in Table 3. The OLS estimates offer first indications that the equalisation policy as a whole is not to be blamed for the growing imbalance in the league. For instance, Draft and Team Salary Floor are two encouraging policies that are tied with significantly lower match margins on average, implying that priority draft pick and the enforcement of a minimum level of compensation a team should receive could help the competition achieve evenness. Instead, the apparent failure of the equalisation policy appears to be due to specific interventions that were unable to keep the imbalance in check. Our OLS estimates speak of three such policies – salary cap, league revenue sharing and country zoning – that have strong, positive associations with match margins. The (positive) coefficients on *Salary Cap* and *League Revenue Sharing* are so much larger in magnitude than the combined (negative) coefficients on *Draft* and *Team*

[11] In a single regressor model, the conditional expectile is a straight line, just like the conditional mean and the conditional quantile. In a multiple regressors model, the conditional expectile is a hyperplane.

[12] See, also, Jones (1994) for a justification of the existence of a one-to-one mapping between expectiles and quantiles.

Salary Floor that any benefit brought about by Draft and Team Salary Floor could be easily overwhelmed.

OLS regression only looks at one summary statistic of the conditional distribution – the conditional mean. However, bringing down the average match margin is unlikely to be the main purpose of the interventions, which is to prevent clear one-sided matches. Therefore, to see if the intervention policies are effective, it is more meaningful to examine their distributional consequences and look at how they are associated with the size of match margins themselves. To do so, we turn to order probit regression and study the link between the intervention policies and four conditional probabilities association with observing four margin intervals – 1) 0 to 12 points, 2) 13 to 18 points, 3) 19 to 24 points, and 4) (strictly) over 24 points.

The key findings from our ordered probit regression, which is reported in Table 4, are consistent with our OLS results. For instance, our probit regression, like our OLS estimates, have identified three "offending" policies – salary cap, league revenue sharing and country zoning – that are strongly associated with worsening match margins. In particular, Table 2 shows that *Salary Cap*, *League Revenue Sharing* and *Country Zoning* are associated with a 5.2 to 10.8 percentage point *increase* in the probability of observing a very large margin of over 24 points (Column (IV)), along with a 4 to 8.7 percentage point *decrease* in the probability of observing a narrow margin of 0 to 12 points (Column (I)). Hence, instead of helping, these policies could exacerbate the problem they are meant to address in the first place. In fact, their negative association with match margins are so powerful that they completely negate the positive association related to *Draft* and *Team Salary Floor*, which are both marked by the *decrease* in the probability of observing an over 24 point margin (Column (IV)) and the *increase* in the probability of observing a 0 to 12 point margin (Column (I)).

To further explore the distributional consequences of the intervention policies on match margins, we examine the relation between these policies and specific quantiles of match margins that is reported in Table 5. The upper quantiles of match margins are the objects of interest, since they represent large margins that threaten the competitive balance of the AFL. A good intervention policy would reduce large match margins with greater force, hence, its negative association with large match margins (upper quantiles) would be stronger than with small match margins (lower quantiles). Similarly, a weak policy could exacerbate the one-sidedness in the league, so that the positiveness of its effect might be more pronounced in regressions involving the upper quantiles of match margins.

We examine the variations of the coefficients associated with each policy when moving towards the higher quantiles of match margins. As expected, salary cap, league revenue sharing and country zoning are three policies with positive coefficients that increase most rapidly towards the higher quantiles of match margins, where for example, their association with the 75th match margin percentile is already at least 50 percent stronger than their association with the median match margin. Among them, our estimates show that league revenue sharing is a particularly troubling policy. While the coefficients on *Salary Cap* and *Country Zoning* display little variation between the 75th and 90th percentile regressions, the coefficient on *League Revenue Sharing* in the 90th percentile regression is about twice as large. Even though our regressions are not causal, seeing the remarkably sharp increase in the coefficient of *League Revenue Sharing* in the upper extreme quantile that is not observed anywhere else suggests that if there is one policy detrimental to tight match margins, league revenue sharing could be it.

Throughout our regressions, both control variables have coefficients that are in line with our expectations, whether we focus on the conditional mean of match margins or their conditional distribution. *Finals* is correlated with lower match margins, as it captures matches between the best teams of a given season, while *Struggle* is linked with higher match margins. The latter effect is highly likely due to the difference in teams levels, but could also capture the incentives for a team out of final contention to "tank". This intuition is reinforced by the fact that, when looking at the ALS regressions, the highest jump in this variable coefficient arises when moving from the 25th to the 50th percentile, thus suggesting that once the fate of the match is likely to be sealed, a trailing team is likely to consign itself to defeat. On the policy side, Coulter Law, metropolitan zoning and gate revenue sharing remained relatively insignificant, and very little can thus be said about them, apart from the fact that they seem to be ineffective.

Although we cannot conclude that these intervention policies had contributed to higher match margins, we can safely say that at best, they were ineffective in maintaining the level of evenness once enjoyed by the league. At worst, it could be that these policies had contributed to the widening gap of the match margins, although this cannot be properly assessed.

6 Robustness Checks

We now consider two further robustness checks. To keep things concise, we only report the new results for the ordered probit and the ALS regression.

The first robustness check considers whether our baseline findings are sensitive to the inclusion of the two control variables, *Finals* and *Struggling*. Table 6 reports the ordered probit results when *Finals* and *Struggling* are omitted from the model. Compared with the estimates in Table 4, the estimates in Table 6 turn out to be nearly identical. The robustness of our results to excluding *Finals* and *Struggling* also carries forward to the ALS regression, which can be observed when comparing between the new estimates in Table 7 with the baseline estimates in Table 5.

In practice, it is not feasible to control for every possible determinant. However, from the baseline regressions, we know that *Finals* and *Struggling* are both statistically and quantitatively important control variables. Therefore, if our results are susceptible to the problem of omitted variables, they would be fragile to the exclusion of *Finals* and *Struggling*. In this regard, given that our estimates are very similar despite the "experiment" of excluding *Finals* and *Struggling*, this provides some indication that our findings are not artificially driven by the omitted variables.

The second robustness check considers the possibility that the average match margin may be trending over time. To address this issue, we include a time trend and its squared to control for any possible trending behavior that the average match margin might have.[13] In both ordered probit (Table 8) and ALS (Table 9) regressions, the effect of trend on match margins turn out to be very close to zero. Moreover, the qualitative observations about the salary cap, league revenue sharing and country zoning policies remain unchanged. For example, in the ordered probit regression (Table 8), *Salary Cap*, *League Revenue Sharing* and *Country Zoning* are positively associated with large match margins but negatively associated with small match margins. Likewise, in the ALS regression (Table 9), salary cap, league revenue sharing and country zoning are once again the three policies that have the most rapidly rising coefficients when we focus on increasingly higher quantiles of match margins. Since these are exactly the same conclusions made earlier, this implies that our baseline analysis is unlikely to be mistakenly driven by trends.

7 Conclusion

The competitiveness of a league is one of the most important issues that dominate the literature in sports economics. Recognized as early as Knowles and Haupert (1992),[14] the lack of parity is an important threat to maintaining fan interest in sports.[15] The AFL is arguably the most popular professional sport in Australia. However, despite the strong

[13]We have tried using a linear trend and the results turn out to be very similar.

[14]See, also, Downward and Dawson (2002) for a review.

[15]For instance, the surge in popularity in the NFL in the early 2000s could be due to the increased parity (i.e. competitiveness) among teams. See, "The NFL Machine", *Business Week*, January 27, 2003

interest in the AFL and the ever present objective of maintaining competitiveness by the AFL commission, there is no systemic econometric inquiry into whether the AFL equalisation policies are indeed associated with the improvement of competitiveness in the league.

To the best of our knowledge, our paper is the first to use a rigorous econometric approach to study the association of key equalisation policies of the AFL commission with competitive balance in the league. In particular, we conduct a qualitative (non-causal) analysis of the link between the AFL equalisation policy and the league's individual match margins. We find that most intervention policies implemented by the AFL/VFL throughout the years have been ineffective at best, and at worst, damaging to an even-playing field. The only two policies that seem beneficial for reducing match margins are: the minimum spending requirement on players' wages that is implemented from 1999 onwards, which is captured by our policy variable *Team Salary Floor*; the priority draft picks policy, implemented from 1993 onwards, captured by our *Draft* variable. With respect to the other current policies in place, team salary cap paired with reverse order draft and league revenue sharing seem to offer little help, if any, in maintaining tight margins. It is therefore timely that AFL convened their recent special meeting to scrutinise its current equalisation strategy, although history suggests that the path to achieving balance in the league is likely to be long and protracted.

Our paper is also the first in the literature to study the distributional effects of equalisation policies on competitive balance. Besides the benefit of allowing us to inspect the distributional consequences of equalisation policies in general, a quantile regression-type analysis that we consider here is itself a form of robust estimation technique Koenker (2005). Therefore, instead of OLS regression, which perhaps is the most commonly employed estimation technique in the literature, it would be useful to consider a quantile-based approach when examining the issue of competitive balance related to other professional sports such as the Major League Baseball (MLB), National Football League (NFL) and National Hockey League (NHL) in the US, where evidence on the effectiveness of certain policies do not al-ways concur.[16] The OLS estimation results also appear to be sensitive to how competitive balance is measured. For example, when competitive balance is measured by the Herfindahl-Hirschmann Index (HHI), Larsen et al. (2006) find that salary caps tend to promote competitive balance in the NFL. However, they do not observe a statistically significant result when competitive balance (or imbalance) is measured using a standard deviation approach.[17] Hence, it might be useful to consider a "robustified" analysis by using a more data insensitive approach such as quantile or ALS regression.

[16]For example, Zimbalist (2001) and Fishman (2003) find that reverse order draft is effective for improving competitiveness in the MLB. This is despite the fact that the invariance principle suggests that competitive balance should not be affected by the implementation of reverse order draft. See, for example, Fort (2010).

[17]This approach compares the standard deviation of winning percentages of teams in a league to the ideal standard deviation if teams were of equal strength. See, also, Noll (1988) and Scully (1989) for a discussion on this approach.

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Table 1: Summary Statistics of Match Margins

Mean	31.73
Median	26
Standard Deviation	25.18
Minimum	0
Maximum	190
Count	13581

Table 2: Average Match Margin in Different Policy Periods

Policy Periods	**Policy**	**Average Match Margin**
1897-1914	"Free Agency"	27.52
1915-1929	Metropolitan Zoning	26.48
(1930-1944)	Metropolitan Zoning + Coulter Law	29.48
1945-1967	Metropolitan Zoning + Coulter Law + Gate Revenue Sharing	28.70
1968-1984	Metropolitan Zoning + Gate Revenue Sharing + League Revenue Sharing + Country Zoning	33.07
1985-2009	Team Salary Cap + Draft (From 1993) + Gate Revenue Sharing (Abolished 1999) + League Revenue Sharing + Total Player Payments (From 1999, includes Team Salary Cap)	36.41
Average (1897-2009)		31.73

Note: Total Player Payments is represented by Team Salary Cap and Team Salary Floor combined.

Table 3: Ordinary Least Squares Estimations

Dependent Variable: Margin	
Coulter Law	1.949
	(0.779)
Country Zoning	3.286
	(1.143)
Draft	-2.807
	(1.391)
Gate Revenue Sharing	-0.030
	(0.687)
League Revenue Sharing	4.251
	(1.065)
Metropolitan Zoning	-0.628
	(0.820)
Salary Cap	7.090
	(1.483)
Team Salary Floor	-2.198
	(1.245)
Finals	-1.698
	(1.030)
Struggling	8.182
	(1.923)

Table 4: Ordered Probit Estimation (Marginal Effects)

	Dependent Variable: Margin Interval (y)			
	(I) $0 \leq y \leq 12$	(II) $13 \leq y \leq 18$	(III) $19 \leq y \leq 24$	(IV) $y > 24$
Coulter Law	-0.033	-0.006	-0.002	0.042
	(0.012)	*(0.002)*	*(0.001)*	*(0.015)*
Country Zoning	-0.050	-0.009	-0.003	0.062
	(0.017)	*(0.003)*	*(0.001)*	*(0.021)*
Draft	0.033	0.006	0.002	-0.042
	(0.019)	*(0.003)*	*(0.001)*	*(0.024)*
Gate Revenue Sharing	0.004	0.001	0.000	-0.005
	(0.011)	*(0.002)*	*(0.001)*	*(0.013)*
League Revenue Sharing	-0.042	-0.007	-0.003	0.052
	(0.016)	*(0.003)*	*(0.001)*	*(0.019)*
Metropolitan Zoning	0.009	0.002	0.001	-0.011
	(0.013)	*(0.002)*	*(0.001)*	*(0.016)*
Salary Cap	-0.087	-0.015	-0.006	0.108
	(0.021)	*(0.004)*	*(0.001)*	*(0.026)*
Team Salary Floor	0.018	0.003	0.001	-0.023
	(0.018)	*(0.003)*	*(0.001)*	*(0.022)*
Finals	0.027	0.005	0.002	-0.034
	(0.016)	*(0.003)*	*(0.001)*	*(0.020)*
Struggling	-0.060	-0.011	-0.004	0.075
	(0.024)	*(0.004)*	*(0.002)*	*(0.030)*

Table 5: Asymmetric Least Square Estimations

	Dependent Variable: τ Quantile of Margin				
	(I)	(II)	(III)	(IV)	(V)
	$\tau = 0.1$	$\tau = 0.25$	$\tau = 0.5$	$\tau = 0.75$	$\tau = 0.9$
Coulter Law	0.311	0.975	1.719	2.414	3.507
	(0.097)	*(0.059)*	*(0.037)*	*(0.026)*	*(0.020)*
Country Zoning	0.864	1.881	2.892	4.248	5.020
	(0.133)	*(0.081)*	*(0.051)*	*(0.036)*	*(0.027)*
Draft	-0.557	-1.321	-2.479	-3.472	-4.028
	(0.152)	*(0.092)*	*(0.057)*	*(0.040)*	*(0.030)*
Gate Revenue Sharing	-0.203	-0.270	-0.089	-0.102	-0.862
	(0.087)	*(0.052)*	*(0.033)*	*(0.023)*	*(0.017)*
League Revenue Sharing	0.994	1.932	3.613	6.087	11.274
	(0.122)	*(0.075)*	*(0.047)*	*(0.033)*	*(0.025)*
Metropolitan Zoning	-0.112	-0.477	-0.568	-0.717	-0.686
	(0.102)	*(0.062)*	*(0.039)*	*(0.027)*	*(0.020)*
Salary Cap	0.863	3.009	6.119	9.414	10.327
	(0.159)	*(0.098)*	*(0.062)*	*(0.043)*	*(0.033)*
Team Salary Floor	-0.479	-1.340	-1.869	-3.725	-6.980
	(0.144)	*(0.086)*	*(0.054)*	*(0.037)*	*(0.028)*
Finals	-0.403	-1.073	-1.575	-2.309	-4.039
	(0.125)	*(0.076)*	*(0.049)*	*(0.034)*	*(0.025)*
Struggling	1.521	3.644	7.112	10.189	10.424
	(0.193)	*(0.112)*	*(0.071)*	*(0.048)*	*(0.034)*

Table 6: Robustness Check 1a: Omitting *Finals* and *Struggling* in the Ordered Probit Estimation (Marginal Effects)

	Dependent Variable: Margin Interval (y)			
	(I) $0 \leq y \leq 12$	(II) $13 \leq y \leq 18$	(III) $19 \leq y \leq 24$	(IV) $y > 24$
Coulter Law	-0.033	-0.006	-0.002	0.041
	(0.012)	*(0.002)*	*(0.001)*	*(0.015)*
Country Zoning	-0.049	-0.009	-0.003	0.061
	(0.017)	*(0.003)*	*(0.001)*	*(0.021)*
Draft	0.035	0.006	0.002	-0.043
	(0.019)	*(0.003)*	*(0.001)*	*(0.024)*
Gate Revenue Sharing	0.004	0.001	0.000	-0.005
	(0.011)	*(0.002)*	*(0.001)*	*(0.013)*
League Revenue Sharing	-0.042	-0.008	-0.003	0.053
	(0.016)	*(0.003)*	*(0.001)*	*(0.019)*
Metropolitan Zoning	0.009	0.002	0.001	-0.011
	(0.013)	*(0.002)*	*(0.001)*	*(0.016)*
Salary Cap	-0.090	-0.016	-0.006	0.112
	(0.021)	*(0.004)*	*(0.001)*	*(0.026)*
Team Salary Floor	0.017	0.003	0.001	-0.021
	(0.018)	*(0.003)*	*(0.001)*	*(0.022)*

Table 7: Robustness Check 1b: Omitting *Finals* and *Struggling* in the Asymmetric Least Square Estimations

	Dependent Variable: τ Quantile of Margin				
	(I)	(II)	(III)	(IV)	(V)
	$\tau = 0.1$	$\tau = 0.25$	$\tau = 0.5$	$\tau = 0.75$	$\tau = 0.9$
Coulter Law	0.316	0.963	1.667	2.310	3.394
	(0.096)	*(0.059)*	*(0.037)*	*(0.026)*	*(0.020)*
Country Zoning	0.857	1.828	2.754	4.014	4.737
	(0.137)	*(0.081)*	*(0.051)*	*(0.035)*	*(0.027)*
Draft	-0.539	-1.409	-2.625	-3.694	-4.383
	(0.152)	*(0.091)*	*(0.057)*	*(0.040)*	*(0.030)*
Gate Revenue Sharing	-0.205	-0.255	-0.042	-0.036	-0.794
	(0.087)	*(0.052)*	*(0.033)*	*(0.023)*	*(0.017)*
League Revenue Sharing	1.001	1.961	3.667	6.180	11.392
	(0.133)	*(0.074)*	*(0.047)*	*(0.033)*	*(0.025)*
Metropolitan Zoning	-0.114	-0.462	-0.532	-0.644	-0.647
	(0.101)	*(0.061)*	*(0.039)*	*(0.027)*	*(0.020)*
Salary Cap	0.948	3.231	6.510	10.006	11.116
	(0.165)	*(0.097)*	*(0.062)*	*(0.043)*	*(0.033)*
Team Salary Floor	-0.525	-1.296	-1.725	-3.490	-6.809
	(0.144)	*(0.086)*	*(0.054)*	*(0.037)*	*(0.028)*

Table 8: Robustness Check 2a: Including *Trend* and Its Squared in the Ordered Probit Estimation (Marginal Effects)

	Dependent Variable: Margin Interval (y)			
	(I) $0 \leq y \leq 12$	(II) $13 \leq y \leq 18$	(III) $19 \leq y \leq 24$	(IV) $y > 24$
Coulter Law	-0.025	-0.004	-0.002	0.031
	(0.015)	*(0.003)*	*(0.001)*	*(0.018)*
Country Zoning	-0.027	-0.005	-0.002	0.034
	(0.020)	*(0.004)*	*(0.001)*	*(0.025)*
Draft	0.060	0.011	0.004	-0.075
	(0.023)	*(0.004)*	*(0.002)*	*(0.029)*
Gate Revenue Sharing	0.033	0.006	0.002	-0.041
	(0.017)	*(0.003)*	*(0.001)*	*(0.021)*
League Revenue Sharing	-0.024	-0.004	-0.002	0.030
	(0.018)	*(0.003)*	*(0.001)*	*(0.023)*
Metropolitan Zoning	0.023	0.004	0.002	-0.028
	(0.020)	*(0.003)*	*(0.001)*	*(0.024)*
Salary Cap	-0.049	-0.009	-0.003	0.060
	(0.027)	*(0.005)*	*(0.002)*	*(0.034)*
Team Salary Floor	0.063	0.011	0.004	-0.078
	(0.028)	*(0.005)*	*(0.002)*	*(0.035)*
Finals	0.027	0.005	0.002	-0.034
	(0.016)	*(0.003)*	*(0.001)*	*(0.020)*
Struggling	-0.059	-0.011	-0.004	0.074
	(0.024)	*(0.004)*	*(0.002)*	*(0.030)*
Trend	-0.001	-0.000	-0.000	0.001
	(0.001)	*(0.000)*	*(0.000)*	*(0.002)*
$Trend^2$	-0.000	-0.000	-0.000	0.000
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*

Table 9: Robustness Check 2b: Including *Trend* and Its Squared in the Asymmetric Least Square Estimations

	Dependent Variable: τ Quantile of Margin				
	(I)	(II)	(III)	(IV)	(V)
	$\tau = 0.1$	$\tau = 0.25$	$\tau = 0.5$	$\tau = 0.75$	$\tau = 0.9$
Coulter Law	0.514	0.934	1.473	2.628	4.286
	(0.114)	*(0.071)*	*(0.045)*	*(0.031)*	*(0.023)*
Country Zoning	0.773	1.257	1.681	3.193	3.788
	(0.153)	*(0.095)*	*(0.060)*	*(0.041)*	*(0.031)*
Draft	-0.573	-2.084	-3.901	-4.524	-5.012
	(0.183)	*(0.112)*	*(0.069)*	*(0.048)*	*(0.036)*
Gate Revenue Sharing	-0.369	-1.050	-1.512	-1.230	-2.100
	(0.137)	*(0.083)*	*(0.052)*	*(0.036)*	*(0.027)*
League Revenue Sharing	0.675	1.305	2.553	4.810	9.248
	(0.147)	*(0.088)*	*(0.056)*	*(0.039)*	*(0.030)*
Metropolitan Zoning	0.261	-0.522	-0.857	-0.035	1.144
	(0.156)	*(0.096)*	*(0.059)*	*(0.042)*	*(0.032)*
Salary Cap	0.487	2.010	4.414	7.825	8.068
	(0.209)	*(0.131)*	*(0.081)*	*(0.056)*	*(0.043)*
Team Salary Floor	-1.212	-2.828	-4.349	-6.451	-11.104
	(0.228)	*(0.137)*	*(0.085)*	*(0.059)*	*(0.044)*
Trend	-0.044	-0.018	-0.009	-0.099	-0.221
	(0.011)	*(0.007)*	*(0.004)*	*(0.003)*	*(0.002)*
$Trend^2$	0.000	0.001	0.001	0.001	0.003
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*

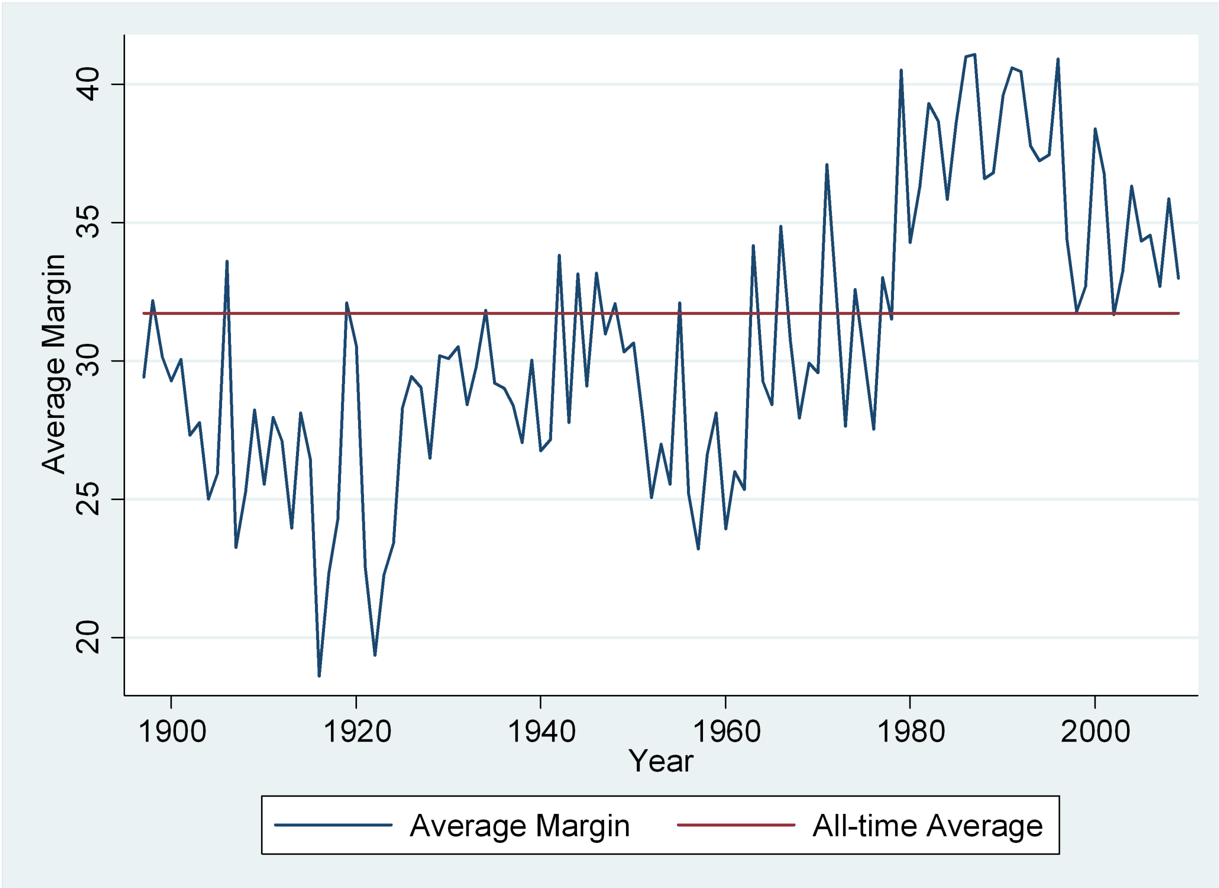

Figure 1: Average Seasonal Margin Over Time