Fan utility in Norwegian football

Do club decisions maximize social welfare?

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1 Introduction

Association football, or soccer is a billion dollar industry on a global scale. The sport is easily the most popular in the world, with a global fan base estimated at more than 3 billion people\(^1\). It is believed that 1 billion people saw the 2014 World Cup final between Germany and Argentina\(^2\). In Norway, football is also an extremely popular sport. It is the biggest sport in terms of participants and also one of the most popular sports in terms of viewers.

This paper will look at the business side of football, how clubs generate income, how income is distributed between competing clubs, and how this distribution affects the utility for the fans, who are the end consumers in football. I will start with a general description of football before I look at how the business of football is run. I show how previous academic work has discussed the incentives of the clubs (the primary decision making agents), and that there is a consensus towards clubs maximizing their wins. I then show what type of market regulation exists in football to try to optimize the allocation of talent between clubs in the same competition. I will then take a look at the Norwegian Tippeligaen in particular, and look at which regulations are used here, and to what extent.

The theory section gives a formal presentation of the incentives for clubs, and show that these are not compatible with social preferences. The model used, assumes that winning is a function of the quantity of talent hired, and that clubs in a free market will have a distribution of talent that is suboptimal. Regulations therefore have the potentially important role of optimizing the allocation of talent between clubs.

Using available data from the Norwegian Tippeligaen in the period 2008-2015, I show that even with existing redistribution, the allocation of talent is not optimal. Specifically, more popular clubs have more talent than ideal, and the league as a whole could benefit from a more equal distribution. I also show that there is a trend towards less competitive balance. This, however, does not affect the efficiency of the league, due to a falling demand for competitive balance by the fans. The raw data requires manipulations and refinement to fit the analysis. Also, the questions raised do not rely heavily on statistical methods. Therefore,

\(^1\) [http://www.topendsports.com/world/lists/popular-sport/fans.htm](http://www.topendsports.com/world/lists/popular-sport/fans.htm)  
analysis in done using Excel, as it offers considerable freedom in preparing and using the data.

Following the analysis, it is shown that certain aspects of the data do not seem to correspond very well with the predictions of the model, indicating that the model may be poorly specified. In particular, competitions are in general more even than what the model predicts, and the free market allocation is more uneven than the model would predict. I will look at possible improvements to the model, in order to better reflect reality. In the final section of this thesis I suggest possible improvements to the redistribution process in Tippeligaen, in order to improve social welfare. At first glance, this thesis might look like an example of “economics imperialism”, the application of economic methods and modeling to non-economic areas. However, football as a business has experienced a huge boom in revenue since the early 1990’s, and is currently comparable to any other business in terms of economic scale. This growth has led to a growing body of theoretical and empirical work by economists to team sports. There already exists a long tradition of economic research into American sports. American research has often focused on profit maximization through cartels. Lately, there is also an increasing amount of research focusing on European team sports, and football in particular. Given the growth in the revenue generated by clubs, football has become a fairly large industry. However, the growth has, as of yet, not led to an enormous amount of regulation, meaning that there is a potential for improvement.

1.1 Definitions

This paper will use some central terms regularly, and a precise definition of these could be useful.

A **club** is an entity that acts as one of two main agents in the market. The club acts both as a supplier and a customer towards other clubs, as an employer to players, and as a supplier to fans. The term team is used interchangeably with team.

**Fans** or **Supporters** is the audience to a game. Fans have several channels to view a game, mainly attending at the stadium, or watching through television. The fans are the other main agents, and are treated as the principal consumers in this thesis. The fans consume through the purchase of viewing rights and purchase of marketing items such as jerseys. In the thesis fans
are divided into two subsets; dedicated and neutrals. Dedicated fans have preferences for a given team, while neutrals prefer a close competition.

**Competitive balance** is the degree to which clubs compete on equal terms athletically. It is typically measured in the winning ratio. Club’s winning ratio is broadly speaking a function of the quantity of talent hired. Thus competitive balance also gives an indication of how uncertain the outcome of a game is. A high degree of competitive balance means that talent is distributed pretty equally across teams, and that the outcome of matches therefore is more uncertain.

**Talent** is a quantitative measure of the skill possessed by players. A team can improve their winning chances by hiring more talent.

A **league** is the primary athletic competition for the clubs. A league is often domestic and, at the top level, has representation from the entire country that it covers. The league is divided into many seasons. In a given season, all teams typically play each other twice, and a winner is declared at the end. Although clubs often compete in multiple competitions, both domestically and internationally, the primary focus in this thesis will be the league competition, as it is what makes up most of the games for a club over a season. The league can thus be viewed as a club’s primary athletic focus.

When referring to **football** in this thesis, the meaning is the European version (association football or soccer). When talking about **American football**, this will be specified.

### 2 About football

"Football is a simple game; 22 men chase a ball for 90 minutes and at the end, the Germans win."

- Gary Lineker

There will not be much focus on the technicalities of the games in this thesis, as this is largely unimportant for the research questions. However, I will present a breakdown of how the sport is organized, and how clubs generate revenue.
2.1 Organization

Football is organized globally by FIFA, which is a non-profit organization. Locally, there are six confederations, corresponding roughly to the continents of the world; UEFA (Europe), CAF (Africa), CONMEBOL (South America) CONCACAF (North and Central America and the Caribbean), AFC (Asia) and OFC (Oceania). UEFA is the European soccer confederation and organizes both the European national sides and European club football. UEFA has 54 members, mainly nations from Europe. As such, the Norwegian football association is a UEFA member. Each member association has a national team and in addition organizes domestic club football. The domestic club competitions are the elements of interest in this thesis. Domestic club football typically consists of a league competition, with multiple tiers, and a knock-out cup competition. This paper will focus at the league competition in Norway, as it is considered the main event in a season.

The league competition usually runs from August to June, though it runs from March to November in Norway. In the competition teams usually play each other twice, once at each team’s home arena. Clubs are awarded three points for a win and one point for a draw. The reason for this is to encourage attacking football, which is often seen as more entertaining. At the end of a season a winner is crowned and the bottom teams are usually relegated to a lower tier, and replaced by the winners there. Typically the 2-3 lowest ranked teams at the end of a season is relegated, and replaced by teams who have played well in a lower tier, as is the case in Norway.

2.2 The business of football

Football has experienced a large influx of revenue over the past few decades. A modern football club is comparable to a firm, and is one of two important agents (Storm 2009:465). The other important agent is the fans. The fans are agents who take interest in the team performance and derive utility based on this. Fans are typically people of close geographic proximity to the home area of the team, but some large teams can have globally significant fan bases, which might even outnumber the “traditional” fans. Fans can be compared to customers, who purchase what the clubs have to sell. This view of the fans is common in sports economics, as seen for instance in Szymanski (2001).
Clubs partaking in the same competitions are of course competitors, but also associates in the sense that certain incentives and goals of a club are shared by the other clubs. While it is in the interest of a club to be athletically successful, it is also an established truth in sports economics that it is in the interest of all clubs to have some degree of competitive balance, as this may increase interest for the consumers (see e.g. Szymanski, 2001 or Késséne 2000). Thus athletic dominance by one team is bad for the competing teams, but also for the dominant team itself. Too much dominance alienates fans, and reduces interest in the game, ultimately also hurting the game itself.

There is a market between clubs, where they act as buyers and sellers towards each other, regarding purchase and vending of talent (players). This market has existed in its current form, since the Bosman ruling in 1995. The Bosman ruling ensured more power to the talent at the expense of the clubs, by ensuring that out of contract players do not hold obligations to their former clubs, but are free to look for employment elsewhere (Ballsoutinpublic 2011). One can therefore think of clubs as agents in two different markets simultaneously, one market where they act as sellers only, and the fans are the buyers, and another market where they can act as both buyers and sellers, and where the other agents are other clubs. This is analogous to goods markets and labor markets in economics in general. The primary market of interest in this paper is the goods market, i.e. the market between clubs who supply entertainment and fans who demand entertainment. The labor market will not be analyzed in any detail, but it is useful to establish that clubs compete to hire talent from a finitely sized pool.

The point of interest for this thesis is to look at how clubs generate income through the goods market, compared to the expenses faced by hiring talent in the labor market. Decisions in hiring talent have an effect on the revenue clubs can generate from fans, which in turn affects how much talent is affordable, leading to a potential spiral effect. This is somewhat simplified, as in reality clubs may also generate income in the labor market, by selling players on a contract to another club.

2.2.1 Incentives

Having established that clubs can be considered a business entity, it is useful to look at incentives for clubs. Convention in economics is of course that agents are utility maximizers. It is also usually assumed that business entities maximize utility by maximizing their profits.
Although this generally seems reasonable, it might not be as simple in competitive sports. In addition to profits, it seems reasonable that clubs also have an interest in maximizing their athletic merit. However, this is typically done by employing talent, which can be expensive given a limited talent pool.

Previous research on team sports has a somewhat ambiguous view of what incentives clubs have. Early research in sports economics was to a large extent done in American sports. A large part of the research on football implies a systematic difference compared to American sports, where soccer often apply less regulation, and a more liberal approach to the market.

Hall and Szymanski (2003), by looking at shifts in the behavior of clubs once they start floating on the stock exchange, do not find any reason to believe that football clubs act as profit maximizers. They find that clubs do not alter their financial strategy once they are publicly traded, meaning that a publicly traded club behaves in the same way as a privately held one. This means that either the clubs were already maximizing profits before floating on the stock exchange, or that shareholders do not care about profit maximizing.

Garcia-del-Barro and Szymanski (2009) use a series of best response strategies, in an effort to approximate optimization strategies to choices done by clubs. They find that actions taken by clubs in England and Spain in the period 1994-2004 are better approximated if it is assumed that clubs maximize their number of wins and not their profits.

Késenne (1996) also suggests that clubs maximize their wins, but that in addition clubs have a zero-profit constraint as part of an optimal strategy. This means that clubs will maximize their wins by hiring talent in a competitive labor market. Winning is achieved by outspending other teams, so a given team will spend all available resources to hire talent. This is similar to general single-period static optimization with a budget constraint in micro economics.

By contrast, research on American sports often assumes profit maximization as the primary goal of the business entities. Andreff (2010:9) suggests that this is due to tighter regulations and a closed, cartelized and monopolized competition system. In American sports there is often extensive redistribution and large regulations, and the system is described as quasi-socialist.

Somewhat counter-intuitive, tighter regulations and more extensive redistribution seems to be associated with a profit-maximizing system, while a more laissez-faire system seems to coincide with win maximizing incentives. The general idea in American sports however, is
that competitive balance can be maintained through tight regulation. It is believed that this will attract more fans, thus generating more revenue (Ibid.). American sports are also typically monopolized, so the fans have only one alternative for consumption (e.g. the NFL is the sole provider of American football games, while there are many league systems for European football). Regulation also makes business more predictable for the franchise owners.

Regulations have a potentially important role in European football as well. As will be showed in the theory section, the incentives of the clubs might not lead to a socially beneficial outcome. That is, there are externalities regarding the allocation of resources made by clubs, meaning that society might benefit from another allocation than what clubs will make in a free market. Another way to say this is that the conditions for the first welfare theorem are not satisfied in the talent market for football clubs. Regulation and redistribution can thus serve as a deterrent to this, and lead to a more efficient outcome.

2.2.2 Regulations

Despite the suggestion that football clubs operate in an unregulated market, certain regulations do exist. Below is a set of regulations that often occur in Football. I will also look at some regulations not generally adapted by football, to get a sense of the relative liberal position taken by football authorities. A more detailed analysis for the Norwegian league follows in section 3.

Redistribution in European football is mainly done to income that is generated through the sale of broadcasting rights, meaning that clubs retain the income from merchandise, player sales, match tickets and prize money themselves. As will be looked at later, there are big differences between the leagues as to how much of broadcasting income is redistributed (Peeters 2012).

A set of regulations that has been tried implemented are the Financial Fair Play rules of the UEFA. These rules would force clubs to commit to austerity. The rules would put a flat cap on the deficit a club is allowed to operate with over a three year period, thus reintroducing an incentive for clubs to maximize their income (Vöpel 2011:56). The regulations were enforced
starting in 2011, but has since been challenged in court by the affected clubs, effectively putting many of the points of the scheme on hold\(^3\).

By comparison American sports have much more extensive market regulations than football. There are many measures in place aimed at ensuring competitive balance as a way to maximize profits. Following are some of the regulations put in place in American sports. The three biggest sports in the US are American Football, organized by the NFL, baseball, organized by the MBL and basketball, organized by the NBA. These governing bodies are simply organizations owned by the teams that are part of the competition (Andreff 2000:6). They are thus manifestations of cartels created by the teams. As an example the NFL acts as a special interest organization for the teams, and also organizes the athletic competition.

The cartelization helps maximizing profits when selling broadcasting rights, and is not a redistributive process in itself. There are many mechanisms that serve to increase equality though. All the three big sports in addition to ice hockey have for instance implemented a wage cap (Vrooman 2000:366). This means that there is an agreed upon maximum threshold for total wage expenditures, and no team can exceed this. This of course improves competitive balance by ensuring that no team can outspend others in hiring talent. There are no such regulations in place in European football, meaning that wages are set by the market.

In American football, gate revenue, (sale of match tickets) is shared between the home and away teams, with 40% of the net sum going to the away team (Atkinson, Stanley & Tschirhart 1988:39). This puts a de facto 40% tax on revenue generated from tickets for the home team, meaning that well capitalized may not be as dominant athletically. By contrast, European football often lets home teams retain their gate revenue, with some minor exceptions.

In hiring new talent, American sports utilize a system where they get to pick from a roster consisting of college graduates. To increase competitive balance, the teams that finished last the season before gets the first pick of the new comers, giving the perceived weaker teams a chance to catch up (Andreff 2000:8). By contrast, hiring new talent (i.e. players not already bound by a contract) in European football is, due to the Bosman ruling, largely an unregulated

\(^3\) A discussion of the current state of the FFP rules can be found at [http://www.theguardian.com/football/blog/2015/sep/02/financial-fair-play-manchester-city](http://www.theguardian.com/football/blog/2015/sep/02/financial-fair-play-manchester-city).
process, and the players are treated as regular laborers, meaning they have the same right as everyone else in the EEC area.

All in all, European football has generally adopted a more laissez-faire approach to the business side of the sport. However European football has some redistributive mechanisms. It is common to redistribute broadcasting revenue in football, while other sources of income are as seen retained by the club that generates it. There are also big differences between associations regarding how much is redistributed. There are broadly speaking, two distinct systems of redistribution, one with emphasis on collective bargaining, and quite equal distribution of television revenue, and the other with individual bargaining, where every club negotiates their own deal with network providers. The English Barclays Premier League and the Spanish Liga BBVA are representatives of each system respectively (Peeters 2012).

Generally, a Spanish system favors the bigger teams while an English system favors the smaller teams. With collective bargaining, the smaller teams can piggy-back on the media drawing power of the larger teams, and using monopoly power the overall price for broadcasting will typically be higher. This can be seen empirically in Spanish and English football, where the Premier League typically sells their broadcasting rights at higher prices than Spanish La Liga. However, the bigger clubs in Spain typically receive a higher broadcasting income than their English counterparts.

3 Norwegian football

Football is a very popular sport in Norway, and is considered the most popular sport by active members and together with cross country skiing, handball and biathlon one of the most watched on TV⁴. Norway also has one of the highest ratios of professional players relative to total population. The top tier in Norwegian football is called Tippeligaen, which consists of 16 teams. The league was first played as a single top division in 1963, consisting of 10 teams. The league in its current form has lasted since 2009 when it was expanded from 14 to 16 teams. The name comes from Norsk Tipping (the state monopolized betting agency) who is the main league sponsor, which it has been since 1990. The season runs from March until November, at which time the champion is crowned. The two last teams at the end of a season

⁴ See e.g. https://www.dn.no/dnaktiv/2013/02/12/fortsatt-langrenn-pa-topp.
are relegated, while the third last team can also potentially be relegated, subject to a mini-tournament with one of the top teams in the second tier.

Traditionally, the biggest and most successful teams have been Rosenborg from Trondheim, Vålerenga from Oslo, Brann from Bergen, and Viking from Stavanger.

3.1 Income and redistribution

As with football teams in general, the Norwegian clubs generates income through match tickets, sponsorships, merchandise and broadcasting negotiations. The Norwegian system also follows the general approach of redistributing the broadcasting part of income. Below is a description of the income and redistribution in Norwegian football, provided by Norsk Toppfotball.

The Norwegian system of redistribution falls within the collective bargaining system, as teams have cartelized, and redistribute the income pretty equally. The broadcasting rights in Norway is sold by Fotball Meida AS, a joint venture between the association, Norsk Fotballforbund (NFF), and Norsk Toppfotball (NTF) which is an organization owned equally by all clubs in the top two tiers of the Norwegian league system. NTF is therefore the embodiment of the cartel made by the clubs when negotiating broadcasting rights. Both parties hold 50% of the shares in Fotball Media. The rights are sold for periods of 3-4 years (typically), and potential buyers are required to submit bids. On December 10th 2015, broadcasting rights were sold to Discovery Networks for 2.4bn NOK, for a six year period.

Income from broadcasting deals makes up an important source of income for the clubs. It is also the only income source that is redistributed between the clubs, meaning broadcasting revenue is generally the only tool that regulates the market. A detailed breakdown of how revenue is shared is presented below.

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5 See [http://www.proff.no/roller/fotball-media-as/oslo/-/Z0I85SSZ/](http://www.proff.no/roller/fotball-media-as/oslo/-/Z0I85SSZ/)
3.2 Breakdown of revenue sharing

Generally, the redistribution follows the same pattern from year to year. The revenue raised by selling broadcasting rights is not received in one lump sum, but paid in time wise instalments.

- The gross revenue to be shared consists of the revenue generated through selling the broadcasting rights, sponsorship revenue, received from the sponsor of the league (i.e. Norsk Tipping), and parts of the revenue generated by the national team.
- Collective costs from e.g. broadcasting production is covered by the gross revenue.
- Net revenue is divided between the association (NFF) and NTF. NFF receives 32% of the net revenue, and this is used on grass root projects etc., and not directly distributed to the clubs. Clubs gets revenue from NTF’s share of 68%.
- The sum received by NTF is divided into two pots, one for the second highest tier (currently OBOS-ligaen) and one for Tippeligaen. Tippeligaen receives 81% of this sum.
- The sum to be distributed to the clubs in Tippeligaen is at this roughly 55% of the net revenue. This is further divided into 3 pots:
  - The athletic pot
  - The commercial pot
  - The development pot

The share that goes into each pot is not constant across years, but the athletic pot is always the biggest.

- The development pot is in effect a subsidy of development, where clubs can get parts of wages covered if they hire professional coaches for their youth teams. This is thus an effort to professionalize youth development. This also means that this pot is somewhat uninteresting for this thesis, as it lies outside the scope of the model, and will therefore not be focused on.
- The athletic pot is further divided into 2 pots of equal size, the first half is divided equally among the teams, and the second is divided according to final placement on the league table.
- The commercial pot is divided according to 3 criteria, time slot of the games played, media exposure and stadium attendance.
Teams who play their games at other slots than the main slot (“Hovedrunden”), which is Sunday nights at 18:00, get a monetary compensation as it is considered a disadvantage. This rotates throughout the season, meaning that in the end all teams play roughly the same amount of games on an inferior time slot.

Teams receive revenue based on their media exposure both nationally and locally, in printed and web media. One can assume that this favors bigger teams on a national level, but also incentivizes local media to give their club PR.

Teams receive income based on the attendance at their games.

A graphical summary is given in the following flow chart, with data supplied by Norsk Toppfotball.

Figure 1  Revenue sharing in Tippeligaen
4 Theory

4.1 The model

The model I will be using in this paper is based on one developed by Szymanski (2001). Although the focus of his paper is English football, the model is generic, so extensions to other competitions and even other sports are straight forward. The model is at its core very simple, and some extensions will therefore be made.

Consider a sports competition with 2 teams, team 1 and team 2. Both teams have a dedicated fan base, $\mu_1$ and $\mu_2$. If one assumes that all fans are equal, $\mu_i$ can be viewed as the number of fans that team i has. Dedicated fans derive utility from the success of their club, measured in their winning ratio;

$$U_1=\mu_1w_1 \text{ and } U_2=\mu_2w_2,$$

(1)

Where $w_i$ is team i’s ratio of wins. In Szymanski’s paper, this is referred to as winning percentage, but for semantic reasons, it will be referred to here as winning ratio. The winning ratio of team i depends on the amount of talent it hires;

$$w_i \equiv \frac{t_i}{t_i+t_j}, \text{ } w_i \in [0,1]$$

(2)

As seen, the winning ratio is constrained to take values between and including 0 and 1, where 1 means that all games are won and 0 means that no games are won. Inserting this expression for winning ratio into the expression for fan utility gives.

$$U_1=\frac{\mu_1t_1}{t_1+t_2} \text{ and } U_2=\frac{\mu_2t_2}{t_1+t_2}$$

(1’)

In addition to the dedicated supporters there are a number of uncommitted fans, referred to by Szymanski as couch potatoes. Another less derogatory term is neutrals. Couch potatoes watch the sporting event for the entertainment and spectacle. Their utility increases with more competitive balance, as it delivers the highest entertainment value. Total utility is then expressed the following way;

$$U = U_1 + U_2 + \Theta w_1w_2$$

(3)
Where the last term is the utility of couch potatoes, and Θ is a weight given to them, based on their size. The total utility is thus simply the sum of utility for all agents. One sees that the term for neutral utility for a given weight, Θ, is at its highest when \( w_1 \) equals \( w_2 \), reflecting that couch potatoes demand competitive balance.

By replacing \( w_2 \) with \((1-w_1)\) in the total utility function, and differentiating with respect to \( w_1 \), one gets the winning ratio of team 1 that maximizes utility for the consumers.

\[
w_1^O = \begin{cases} 
1 & \text{if } \mu_1 - \mu_2 \geq \Theta \\
\frac{1}{2} + \frac{\mu_1 - \mu_2}{2\Theta} & \text{if } 1 - \Theta < \mu_1 - \mu_2 < \Theta \\
0 & \text{if } \mu_2 - \mu_1 \geq \Theta 
\end{cases}
\]  

(4)

A capitalized \( O \) denotes an optimal winning ratio, as the more traditional * is utilized for the equilibrium outcome. Since the optimum accounts for the weighed preferences for all fans, it can be viewed as the aggregated demand for competitive balance (or the demand for an average fan).

As one can see directly, a large share of couch potatoes means that competitive balance will be very important (as \( \Theta \) approaches infinity the second term on the right hand side approaches 0, giving an optimal ratio of wins for both teams equal to 1/2). Conversely, a small share of couch potatoes means that the relative sizes of the fan bases decides the socially optimal ratio of wins. Especially when \( \Theta \) approaches 0, the second term approaches infinity. Of course \( w_i \) cannot exceed 1 by definition. Conversely a diminishing \( \Theta \) implies an optimal outcome of less competitive balance, unless the two teams have equal sized supporter bases. A very large share of couch potatoes or equal support to both teams is actually the only two instances in this model where perfect competitive balance is the socially optimal outcome.

When it comes to the clubs it is assumed that they are profit maximizers. As seen, this is generally not supported by empirical research. Further it is assumed that clubs can monetize a fraction of the utility fans get from success through ticket sales etc. In the model it is assumed that clubs cannot monetize any utility from the couch potatoes. Teams can also employ talent at a constant marginal cost, \( c \). Team i’s profit function can accordingly be expressed by

\[
\pi_i = \phi \mu_i w_i - c t_i
\]

(5)

\( \phi \) is the fraction of utility \( \mu_i w_i \) that can be monetized and appropriated by the club from its fans. \( c \) is the constant marginal cost of employing talent \( t_i \). This specification of profits makes
the distinction between win maximizing and profit maximizing less important, as maximizing profits means maximizing wins, subject to the cost of talent. A good property of this specification is that it captures some of the incentives clubs have for winning, yet recognizes the importance of profit. Replacing \( w_i \) with \( \frac{t_i}{t_i + t_j} \), \( (i \neq j) \) and differentiating with respect to talent, yields the optimal employment of talent for team \( i \), given a level \( t_j \) of talent for team \( j \):

\[
\frac{\partial \pi_i}{\partial t_i} : \phi \mu_i \frac{t_i}{(t_i + t_j)^2} = c
\]

Similarly, optimal employment for team \( j \neq i \) is

\[
\frac{\partial \pi_j}{\partial t_j} : \phi \mu_j \frac{t_j}{(t_j + t_i)^2} = c
\]

Since both left hand terms equal the constant \( c \), they must equal each other as well:

\[
\phi \mu_i \frac{t_j}{(t_i + t_j)^2} = \phi \mu_j \frac{t_i}{(t_j + t_i)^2}
\]

which can be simplified by multiplying with \( \frac{(t_i + t_j)^2}{\phi} \) on both sides, giving

\[
\mu_i t_j^* = \mu_j t_i^*
\]

or

\[
\frac{t_i^*}{t_j^*} = \frac{\mu_i}{\mu_j}
\]

Recognizing that this term equals \( \frac{w_i}{w_j} \), and that generally, \( \frac{t_i}{t_j} = \frac{w_i}{w_j} \), and by using equation 4, one can infer that

\[
\frac{w_i^O}{w_j^O} = \frac{1 + \frac{\mu_i - \mu_j}{2 \theta}}{1 + \frac{\mu_j - \mu_i}{2 \theta}}
\]

Or, by manipulating the expressions

\[
\frac{t_i^O}{t_j^O} = \frac{\theta + \mu_j - \mu_i}{\theta + \mu_i - \mu_j}
\]
6’ says that the equilibrium relative investment in talent for both teams equals the relative sizes of their fan bases. Comparing equation 4, which gives an expression that maximizes the social welfare, and equation 6, which maximizes the individual teams’ utility, one sees that the individual optimization does not necessarily maximize social welfare. Under certain assumptions however, the individual optimization will actually maximize social welfare. If fan bases are of equal size, that is if \( \mu_i = \mu_j \), equation 4 implies that the optimal winning ratio for team i is \( \frac{1}{2} \). Equation 6, implies that teams will indeed aim for equally sized talent pools, indicating that the optimal \( w_i \) is reached.

If the fan bases are of different sizes, e.g. if \( \mu_i > \mu_j \), equation 4 gives the socially optimal winning ratio of team i, while their investment in talent is given by equation 6. Combining them, one finds that in order for the investment to be optimal, the following must hold:

\[
\frac{\mu_i}{\mu_j} = \frac{1}{2} + \frac{\mu_j - \mu_i}{2\theta}
\]

Meaning that when team i makes decisions for \( t_i \) given \( t_j, \mu_i \) and \( \mu_j \), the social optimality of this decision depends on \( \theta \). Thus for every value of \( t_i \) there exists a corresponding \( \theta \) that maximizes social welfare.

Solving the above equation with respect to \( \mu_i, \mu_j \) and \( \theta \), one gets that \( \theta = \mu_i + \mu_j \) ensures optimality. So for any \( \mu_i \) and \( \mu_j \), the market allocation is optimal if, and only if the weight of couch potatoes is equal to the weight of dedicated fans.

To illustrate this point, one can consider a theoretical example, e.g. by arbitrarily setting the sizes of the fan bases to 2 for team 1 and 1 for team 2 (i.e. \( \mu_1 = 2 \) and \( \mu_2 = 1 \)) and setting the weight of couch potatoes \( \theta \) to 3/2. By equation 4, the socially optimal fraction of wins for team 1 equals 5/6, while equation 6 states that their individually best investment in talent is twice the talent hired by team 2, which will give a ratio of wins equal to 2/3, less than the socially optimal levels of win for team 1. If instead, \( \theta \) is set to 3, the optimization done by clubs maximizes social welfare.

This clarifies why neutral fans constitute a potential externality. The market outcome is sub optimal, because clubs do not take couch potato utility into consideration. This is an important
result. As seen, the market outcome is efficient only under some very strong assumptions. To see if any improvements can be made to the market, one can make some key changes.

The assumption that couch potatoes do not generate income to the clubs seems somewhat strong, and as such could be changed. It is realistic to assume that couch potatoes consume less than committed fans, but they probably provide clubs with some revenue. Including this in the model, will force the clubs to take neutral utility into consideration, reducing the externality effect. Another extension that can be made is adding a central government type entity, which decides how to divide revenue produced by couch potatoes. Note that the extended version of the model will not be followed exactly when analyzing, and that the additions are meant as a supplement to the simple model, to get an indication of the effect of neutrals.

4.1.1 Extension:

- Couch potatoes, on average generate less income than dedicated fans
- Income generated by couch potatoes is redistributed by a governing body (i.e. the association.)

These assumptions are pretty straight forward to justify. In contrast to dedicated fans, couch potatoes will not consume as much. E.g. couch potatoes will only consume broadcasted matches, and not match tickets and merchandise. As seen, broadcasting revenue is subject to redistribution.

The functions for utility (1-4) and socially optimal winning ratio is unchanged by this extension, but club optimization is changed.

Team i’s profit function now becomes

\[ \pi_i = \phi w_i + [kd_i]\phi \theta w_i w_j - ct_i \]

(5b)

It is thus assumed that clubs can monetize some k fraction of couch potatoes’ utility, k is assumed to be between 0 and 1, reflecting that couch potatoes consume less than dedicated fans (k\(\phi < \phi\)). Whatever income that is extracted from couch potatoes is divided as decided by the association, and team i is given a dividend equal to \(d_i\) of the total revenue, thus \(0 \leq d_i \leq 1\) and \(\sum_{i=1}^{2} d_i = 1\). If one assumes that revenue generated through couch potatoes is divided equally amongst teams, the model solves very nicely, and the profit function becomes:
\[ \pi_i = \varphi \mu w_i + \frac{k}{2} \varphi \theta w_i w_j - c t_i \]

Replacing \( w_j \) with \((1 - w_i)\) and differentiating with respect to \( t_i \) gives

\[
\frac{d\pi_i}{dt_i} \rightarrow \varphi \mu_i \frac{t_j}{(t_j + t_i)^2} + \varphi \theta \frac{k}{2} \frac{t_1}{(t_j + t_i)^2} - \varphi \theta \frac{k}{2} \frac{2t_i t_j}{(t_j + t_i)^3} = c
\]

which simplifies to

\[
\varphi \mu_i \frac{t_j}{(t_j + t_i)^2} + \varphi \theta \frac{k}{2} \frac{t_j}{(t_j + t_i)^2} - \varphi \theta \frac{k}{2} \frac{t_i t_j}{(t_j + t_i)^3} = c
\]

And the equivalent is true for team j. If both equations equal the constant \( c \) they must also equal each other, giving

\[
\varphi \mu_i \frac{t_j}{(t_j + t_i)^2} + \varphi \theta \frac{k}{2} \frac{t_j}{(t_j + t_i)^2} - \varphi \theta \frac{k}{2} \frac{t_i t_j}{(t_j + t_i)^3} = \varphi \mu_j \frac{t_i}{(t_j + t_i)^2} + \varphi \theta \frac{k}{2} \frac{t_i}{(t_j + t_i)^2} - \varphi \theta \frac{k}{2} \frac{t_i t_j}{(t_j + t_i)^3}
\]

which can be simplified to

\[
\mu_i t_j + \frac{k}{2} t_j - \varphi \theta \frac{k}{2} \frac{t_i t_j}{(t_j + t_i)} = \mu_j t_i + \frac{k}{2} t_i - \varphi \theta \frac{k}{2} \frac{t_i t_j}{(t_j + t_i)}
\]

This is easily rearranged to get

\[
\mu_i t_j + \frac{k}{2} t_j = \mu_j t_i + \frac{k}{2} t_i
\]

which is further simplified to

\[
t_i [\mu_j + \frac{k}{2}] = t_j [\mu_i + \frac{k}{2}] \quad (6^b)
\]

which finally gives:

\[
\frac{t_i^*}{t_j^*} = \frac{\mu_i + 0.5k\theta}{\mu_j + 0.5k\theta} = \frac{2\mu_i + k\theta}{2\mu_j + k\theta}
\]

The basic model showed that

\[
\frac{t_i^*}{t_j^*} = \frac{\mu_i}{\mu_j} \quad (6^* )
\]
indicating equilibrium where the teams’ relative employment of talent equals the relative size of their fan base. When income from neutrals is added, the relative size of fan bases is still an important factor to decide the market outcome of employment, but the effect is dampened, as clubs now have an incentive to aim for some level of competitive balance. How efficient the market equilibrium is depends on factors $k$ and $\theta$. One can see that as $\theta$ approaches infinity (i.e. as the share of total utility derived from couch potatoes becomes infinitely large), the term $\frac{2\mu_i + k\theta}{2\mu_j + k\theta}$ approaches 1, meaning that teams will employ equal amounts of talent, $t_i = t_j$.

This makes sense of course, since the utility of neutrals is weighed heavily. Neutral utility is maximized with perfect competitive balance. When $\theta$ approaches 0 (i.e. all utility is derived from dedicated fans) the model gives the same results as the basic model, since couch potatoes no longer generate utility, and by extension income.

$k$ is the factor that discounts couch potato utility, since they consume and invest less than dedicated fans. One can see that as $k$ gets smaller (indicating that neutrals’ propensity to consume becomes less), the importance of competitive balance diminishes. This seems intuitive as clubs will not cater to agents demanding competitive balance if they do not wish to pay for it. As $k$ increases the opposite is true, by the same logic.

There are natural limitations to the amount that the fraction $t_i/t_j$ will grow. As seen $w_i = \frac{t_i}{t_i + t_j}$, and since it represents the winning fraction, it cannot, by definition exceed 1. Of course, there is no theoretical limit to the absolute amount of talent employed, but at a point, employing more talent will not grant a team more wins (specifically when $w_i = 1$). Employing talent beyond this point is thus always irrational, as it is an extra cost without any benefits.

Assuming that money is divided unequally between teams makes the model much harder to solve, unless one makes some manipulations. One such manipulation is to standardize the size of the talent pool to unity, $\sum_{i=1}^{2} t_i = 1$. By doing this, and calling team i’s share of couch potato revenue $d_i$, one gets the following term for optimal allocation of $t_i$:

$$
\frac{t_i^*}{t_j^*} = \frac{\mu_i + d_i k\theta}{\mu_j + d_j k\theta - 2k\theta t_j (d_i - d_j)} \quad (6^c)
$$

Using this equation, one can get an idea of what happens with different values of $d_i$ and $d_j = 1-d_i$. If $d_i = d_j$, this equation is the same as equation $(6^b)$. In this case both teams get half the neutral revenue, so $d_i = 0.5$, and the rest follows. If $d_i > d_j$, the numerator increases while the
denominator decreases, increasing the allocation of $t_i$. If $d_i < d_j$, the opposite happens, and $t_i$ decreases. Note that there is a possibility for the entire denominator to become negative, indicating a negative investment in talent, which is nonsensical. This is due to the simplicity of the model. A way to ensure this doesn’t happen is to impose restrictions on the parameters. In this case specifically, $\mu_j + (2t_j+1) d_j k \theta > 2k0 t_j d_i$ ensures that negative talent does not happen. Should $\mu_j + (2t_j+1) d_j k \theta < 2k0 t_j d_i$, it is natural to assume that $\frac{w_i}{w_j}$ goes towards infinity, meaning $w_i^*$ goes to 1.

4.1.2 Generalization to more than two teams

The model assumes two teams, which does not correspond very well to reality. Still, it does have its advantages, by being simple and intuitive. For the analysis, however, more teams will be included, and the model requires some refinement. To see the problem that arises with more teams, one can look at e.g. equation 2, which gives team i’s winning ratio. This is a function of the hired talent and team j’s hired talent. However, introducing a team h, it seems obvious that this talent should count as well.

A workaround that solves this problem quite nicely is simply looking at one internal match of one pair of teams, and summing all pairs. Doing this opens for using methods of linear algebra, that will be of great help. The following refinements solve the problem of more teams;

If one redefines equation 2,

$$w_{i,j} = \frac{t_i}{t_i + t_j} \cdot w_{i,j} \in [0,1],$$

one gets an expression for team i’s winning ratio over team j. This in turn gives team i’s fans the following utility from that game;

$$U_{i,j} = \mu_i w_{i,j}.$$ 

Summing over all games for team i gives

$$U_i = \sum_{j \neq i}^{n-1} U_{i,j},$$
where $j$ is summed over all teams that are not $i$. Doing this however, rests on a very strong assumption that probably will not hold in reality; Since internal games are summed over, there is an implication that all games are independent. This means that team $h$ does not account for decisions made by team $i$ regarding team $j$. A more thorough explanation for doing these simplifications, and a discussion about its realism is presented in the analysis.

4.2 Summary and implications of the model

Exogenous variables are;

- $\mu_i$, for all $i$, this represents the fan base size, and is taken as given by the club. In reality, the club can probably alter this through marketing, but it seems reasonable to consider this as given when optimizing.
- $\varphi$ is a parameter, how much of dedicated fan’s utilities the club can monetize.
- $\theta$, the weight of couch potatoes.

All exogenous variables are viewed as given by the clubs when making decisions.

Endogenous variables are

- $t_i$, the amount of talent hired by the clubs, clubs hire talent to maximize their profit function.
- $w_i$, depends on the amount of talent hired, but also the amount of talent hired by the other club.

4.2.1 Optimality conditions

The model gives the following implications for maximum social welfare

- for given values of $\theta$, $\mu_i$ and $t_i$, $t_i^o$ satisfies the following conditions;
  
  1. $\frac{dt_i^o}{d\mu_1} > 0$
  2. $\frac{d^2t_i^o}{d\mu_1^2} > 0$

  This means that for an increasing fan base for team $i$, an increasing amount of talent for is required to reach optimal allocation, and
3. \( \lim_{\mu_1 \to \infty} t_1^O = \infty \)

• For given \( \mu_1 \) and \( \mu_2 \) the following is true

\[
\frac{dt_1^O}{d\theta} > 0 \quad \text{for} \quad \mu_1 < \mu_2 \\
\frac{dt_1^O}{d\theta} < 0 \quad \text{for} \quad \mu_1 > \mu_2 \\
\frac{d^2 t_1^O}{d\theta^2} < 0,
\]

Further implying

4. \( \lim_{\theta \to \infty} w_1^O = 0.5 \)

Which simply means that for an increasing weight of neutrals, the ideal winning ratio of team 1 goes to 0.5, ceteris paribus, and

5. \( \lim_{\theta \to 0} w_1^O = \begin{cases} 1, & \text{for} \quad \mu_1 > \mu_2 \\ 0, & \text{for} \quad \mu_1 < \mu_2 \end{cases} \)

Given that \( \mu_1 > \mu_2 \), point 3 can now be restated as.

6. \( \lim_{w_1 \to 1} t_1^* = \infty \)

• For any constant \( \mu_1, \mu_2 \) and \( t_2 \), \( U(t_1) \) follows a unique trajectory for every value of \( \theta \);

Graphically, with \( \mu_1 > \mu_2 \) and \( t_2=8 \) (chosen arbitrarily) it looks like this.
Figure 2   Ideal $t_1$ for different values of $\theta$

- Holding $t_2$ fixed at some arbitrary constant, $t_2=a$, $t_1$ can also be considered the ratio of talent in team 1 relative to team 2. This is especially clear if one standardizes $t_2$ to 1.
- As seen, the shape of the utility function is similar for different values of $\theta$, however, as $\theta$ increases, $t_1^0$ is pushed towards the left, meaning ideal $t_1$ is less when the weight attached to neutrals is higher. This is because the aggregated demand for competitive balance has increased. In the graph, the function names indicates the weight attached to them, i.e. in the lowest trajectory, there are 1.2 times as many neutrals as dedicated fans. One can see that as the weight to neutrals decreases, more talent is required to reach optimal allocation, as implied by points 6 and 7.
- The following insight will have important implications for later; for any given $\theta$, the market allocation of talent will place $t_1$ to the right of the optimal point, $t_1^*$ (Assuming here that $\mu_1 > \mu_2$). Any redistribution should therefore work towards decreasing $t_1$.
- As $\theta$ increases, $t_1^0$ is further and further away from the allocation chosen by the club, $t_1^*$. Thus more weight on couch potatoes means that more intervention is required in the market to reach optimal allocation.
The increased social utility from a larger weight of couch potatoes is explained by the fact that more agents enters the system, and all agents are always at least weakly better off for entering the system (i.e. there is no disutility from being a fan, at worst a fan receives 0 utility).

4.2.2 Returns to scale

From equation (2), it is clear that the winning function can be regarded as a production function, with two inputs, $t_i$ and $t_j$. This can also be seen by looking at team i’s profit function, where the income part is simply their winning ratio scaled with two exogenous variables, $\phi$ and $\mu_i$. Other team’s talent allocation, $t_j$ must also be taken as given. Team i can thus only affect one variable directly, $t_i$. Production of wins has decreasing returns to scale for the input $t_i$. If the talent is increased by some arbitrary increment $h$, the winning ratio will increase by less than $h$. A simple proof for this can be seen by the fact that the winning ratio function is concave and converges on 1 as $t_i$ increases to infinity. It can also be seen by the sign of the first and second derivatives of $w_i$ with respect to $t_i$:

$$\frac{dw_i}{dt_i} > 0$$
$$\frac{d^2w_i}{dt_i^2} < 0$$

The rate at which $w_i$ converges on 1 with increasing $t_i$ depends on the value $t_j$. For lower values of $t_j$, the marginal product of $t_i$ decreases faster. If $t_j$ is infinitely larger than $t_i$, the marginal product of $t_i$ will appear to be nearly linear. Graphically, this is shown in the following figure.
In this graph, $t_i$ increases along the x-axis. Meanwhile, $t_j$ stays constant. The value of $t_j$ in relation to the first (left most) value of $t_i$ is given on the right. One sees that a higher value of $t_j$ corresponds to a more linear function. This, combined with the profit maximizing incentives of clubs has an important implication, namely that even without regulation, there will likely be some degree of competitive balance. Teams are therefore win maximizers only to a certain extent.

### 4.2.3 Efficiency

At the core, it is evident that dedicated supporters and neutrals have fundamentally different preferences. While dedicated supporters would like to see their team’s winning ratio increase as much as possible, neutrals of course wants this winning ratio to take values close to 0.5. This does not necessarily mean that dedicated supporters and neutrals always have conflicting interests, however. Indeed, fans of a team with a winning ratio less than 0.5 actually has compatible interests with the neutrals, namely to raise the winning ratio of their team. If the winning ratio is more than 0.5 however, neutrals and dedicated supporters have conflicting preferences, and changing the winning ratio comes with a trade-off, where one group is better off and one group is worse off. Increasing the winning ratio of a team also means decreasing the winning ratio of at least one other team, making their fans strictly worse off. This means that any changes in the winning ratio can never be a Pareto improvement, as some agents will always be strictly worse off. By extension, any allocation is Pareto-efficient, and there is no
way to increase the utility of one agent without strictly reducing the utility of at least one other agent.

Since all allocations are Pareto-efficient, one could argue that there is no room for intervention. If efficiency is measured using the Pareto criterion, a central, redistributive agency cannot do better than the market. The Pareto criterion is very stringent however, and some other efficiency criterion might be better suited. If the goal is to maximize social utility, the Kaldor-Hicks criterion is a candidate. Looking at equation 1, utility is a linear function of the winning ratio for a constantly sized fan pool. Also any increase in the winning ratio of one team must be offset by the exact change in winning ratio by another team. Looking at the simple case with only two teams, one sees that any change in the winning ratio will give the following change in total utility

\[
\frac{dU}{dw_i} = \mu_i - \mu_j + \theta(1-2w_i)
\]  

Whether a change in the winning ratio leads to a Kaldor-Hicks improvement or not, depends on the values \(\mu_i, \mu_j\) and \(w_i\). Since a Kaldor Hicks improvement implies that the sum of change in utility is positive, any change in winning ratio that increases total utility will be a Kaldor-Hicks improvement. Expanding on this, it is also clear that the Kaldor-Hicks criterion is satisfied only in the optimal allocation implied by equation 4. Any other allocation could be improved upon. Further, any match between two teams has one, unique optimal allocation if the \(\mu\)’s and \(\theta\) are known. Also, since it is assumed that there is no correlation between matches, the Kaldor-Hicks efficient allocation for a multiple team case can be found by maximizing every match independently.

There are four possible outcomes of altering the winning ratio that can be summarized in a 2x2 matrix, depending on whether \(\mu_i > \mu_j\) or not and whether \(w_i > 0.5\) or not. In the following table, the efficiency of increasing \(w_i\) has the following effect.

**Table 1  Efficiency improvement**

<table>
<thead>
<tr>
<th></th>
<th>(w_i &gt; 0.5)</th>
<th>(w_i &lt; 0.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\mu_i &gt; \mu_j)</td>
<td>Ambiguous</td>
<td>Improvement</td>
</tr>
<tr>
<td>(\mu_i &lt; \mu_j)</td>
<td>Decline</td>
<td>Ambiguous</td>
</tr>
</tbody>
</table>
In the ambiguous cases the change in total utility depends on whether $\mu_i > \theta(1-2w_i) + \mu_j$ or not. E.g. if both $\mu_i > \mu_j$ and $w_i > 0.5$, there is a Kaldor-Hicks improvement if $\mu_i > \theta(1-2w_i) + \mu_j$, that is if team i has a sufficiently large fan base, team j has a sufficiently small fan base and there are sufficiently many couch potatoes. This follows for all the other cases, and in summary, one can state the following; in order for an increase in team i’s winning ratio to be a Kaldor-Hicks improvement, team i’s fan base must be sufficiently large compared to the neutral fans and the fans of team j.

An important implication of this is that optimal redistributive measures depends on exogenous variables, that decision makers do not control, specifically $\mu$ and $\theta$. There is therefore no universal rule of redistribution, and an optimal policy must be tailored to the fundamentals of the competition in question. As has been seen, for instance, Spain and England have chosen different approaches, where the more supported clubs receive a much higher share of income in Spain\(^7\). At the same time however, these big clubs also have far more supporters, and the model therefore suggests that these teams should indeed receive a bigger share of revenue. This means that social welfare might decrease in Spain if they were to adopt a more egalitarian system, and social welfare in England might decrease if they were to adopt a more individualistic approach.

### 4.2.4 Short summary

Clubs will maximize their profit, which is done by maximizing their wins subject to the cost of hiring talent. Due to not fully accounting for neutral preferences, allocations will typically be sub optimal from a social point of view. If a high weight is assigned to neutrals, the allocation chosen by clubs will be less optimal. In order to maximize social welfare, a redistribution policy must consider the relative size of all fan bases and fully incorporate neutrals preferences in the profit functions faced by clubs.

### 4.2.5 Problems and limitations

The simplicity of the model can limit the model in certain areas. One example that was pointed out is that the extended model opens up for a negative investment in talent, which is

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absurd. Generally the simplicity of the model creates limitations for extreme values of different variables. For instance, it seems unreasonable that dedicated fans would prefer total athletic domination by their team, as it would surely reduce interest over time.

Several of the assumptions are also pretty simplistic, and seem unreasonable. Examples include a constant marginal cost of talent, and a constant factor of utility that clubs can extract from fans. It seems more reasonable that there is an increasing marginal cost for talent in a limited talent pool, and that larger clubs are able to extract more utility from their fans than smaller clubs. As will be shown in the analysis, the data also suggest that the returns to scales reduces quicker than what the model suggests.

Another, severe problem is that the expressions for individually optimal talent allocation are not linearly independent. That is, $t_i$ cannot be expressed as a function of exogenous variables only, but rather depends on $t_j$. This also means that there is a degree of freedom in the system of equations, and one parameter must be assigned a value to determine a solution for the other parameters. In the analysis, this is solved since the aggregated size of talent pools is given. Knowing this, the model can be solved with a unique Nash-Equilibrium for internal division of talent between clubs. Without this information, the model gives conditions that must be satisfied to reach a Nash Equilibrium, but a unique solution is not found without knowing the aggregated amount of talent.

5 **Empirics**

In this chapter I will analyze the Norwegian Tippeligaen based on data from different sources. I will provide an analysis of the utility produced for every season between 2008 and 2015. The model presented in the previous chapter is used to analyze. The point of interest is to get a measurement for the utility gained by the community of spectators, and compare this to the utility gained under socially optimal conditions, as implied by equation (4) in the theory chapter. It is also possible to get an estimate of the would-be utility under free market conditions, to see if redistribution has a positive net effect on total utility. The results of the analysis are discussed in the next chapter, and possible improvements to the competition are presented. I will start this chapter by describing the data, where it is found, and if it is reliable. I will then talk about how data is fitted to the model, which requires further refinement of the
multiple teams case presented chapter 4. I will then present the results of the analysis, for the 
mentioned seasons. These seasons are chosen because this is the period where the 
necessary data is available. The section is ended by a discussion on the reliability and validity 
of the analysis.

5.1 Data

5.1.1 Sources of data and reliability
The data used comes from three different sources. The most extensive data set is provided by 
the internet source altomfotball.no, which is Norwegian TV2’s statistics page. The site offers 
a statistical breakdown of every season of Tippeligaen since 1963. It offers the final table, 
information on top scorers, head to head records between teams etc. The most interesting 
statistic for the analysis is the number of supporters attracted to every team’s home game. The 
data is probably quite reliable; especially due to the fact the TV2 has been the main provider 
of broadcasted matches in the period that is looked at. This makes it reasonable to believe that 
the network has knowledge about the league, and reliable contacts to provide the information 
they present. The data on game attendance is used in the analysis to get a weight of every 
team’s fan base, that is, it assigns values to the µ’s.

Data on different club’s investment in talent is found using the internet source Transfermarkt. 
The site offers much of the same statistics as altomfotball, but the latter is preferred when 
possible, due to it being a Norwegian site, while Transfermarkt is a German site. The close 
geographical proximity suggests that altomfotball are better informed. However, altomfotball 
do not present any data on investment in talent, so Transfermarkt supplies the data. There is a 
certain ambiguity about the term “investment in talent”, and Szymanski (2001) does not really 
offer an extensive definition. It is therefore necessary to properly define the term, so that 
there is an understanding of what kind of data is used. The way the term is used in the 
literature on sports economics seem to suggest that the term is quite broad. One possible 
definition is that a team’s investment in talent consists of its wage bill. An argument in favor 
of this is the close correlation between wage bill and position in the league, which has been 
empirically proven (see e.g. Szymanski & Smith 1997:139). This leads to a new problem 
however; availability. A club’s wage bill is usually not in the public domain, and not coded 
and presented anywhere that is easily available. There also doesn’t seem to be enough interest
in the matter to produce reliable estimate from outside sources. If one were to get estimates of the wage bills it would thus be necessary to do extensive work, by contacting clubs and asking for the data directly or checking public statements made by clubs that are floating on the stock exchange. Since the analysis requires estimates for 126 club years (7 seasons with 16 clubs and one season with 14 clubs), this would require work far outside the scope of this thesis. This means that a workaround is needed.

Transfermarkt excels at providing estimates of player values, and this is the data used in the analysis. The site offers estimates of player values for all the squads in the time horizon of the analysis. The data provided by Transfermarkt is often the basis for player evaluation in both academic research and journalism. A question that arises is how player value and wage correlates. To get an idea, one can look at wage bills for clubs big enough for data to be available, and compare with Transfermarkt’s assessment of squad value. Sporting Intelligence’s annual Global Sports salary survey\(^8\) provides information on the wage bills of the 60 highest paying football clubs in Europe. Comparing wage numbers from their 2014 report (source) to evaluations done by Transfermarkt in the same time horizon, reveals a correlation coefficient of 0.92, and a simple linear regression with average wage as dependent and club value as independent (as reported by Sporting Intelligence and Transfermarkt respectively) gives an R\(^2\) of 0.83 with a p-value of 0.000. Although this is a greatly simplified single cross sectional analysis, it gives some credibility to the assumption that player values, as reported by Transfermarkt, provides a good instrument for measuring the wage bill.

A reasonable objection to this is of course that wages are sticky (i.e. lasts the entire period of a contract) while player value is subject to continuous change. However on a large scale, it seems reasonable that these errors cancel out. I will therefore use Transfermarkt’s assessment of squad value as estimates for \(t_i\) in the model.

An interesting point now becomes how the market value of squads is estimated. Of all the parameters needed in the analysis, this data easily seems like the least trustworthy. However, as mentioned, Transfermarkt is often seen as the go-to source to get estimates of player values. The values are estimated using a scout network and discussions between any interested users of the site. All collected data is reviewed by the employees at Transfermarkt. While there is sure to be problems in estimating player values, for the sake of simplicity it is

\(^8\) Found at http://www.globalsportssalaries.com/
simply going to be assumed that Transfermarkt provides accurate estimates of player values. The squad values reported in this thesis is correct as of 12/10-2015.

A final value of interest is the weight given to neutrals. In the model it was assumed that the couch potatoes generate some income, but not as much as dedicated fans. In practice, it is assumed that income generated by neutrals comes from watching games made available through public networks, i.e. networks that do not require a subscription. Numbers for the amount of viewers of publicly broadcasted games are recorded by media analysis bureau Sponsor Insight. Data has been recorded since the 2008 season, and this data thus provides the limit to how far back the analysis can go. A severe limitation with the data is that the only recorded values found are the total number of viewers on public television for a season, and the number of games broadcast on public television. This can provide an average but not much else. Regarding the reliability of the source, it seems quite good given that the data comes from an analysis bureau. It can safely be assumed that Sponsor Insight has incentives to provide the most trustworthy data possible.

5.1.2 A descriptive look at the data.

The variables of interest are $\mu_i$, $t_i$ and $\theta$. All other variables, like the winning ratio is endogenously decided. As seen, $\mu_i$ and $\theta$ are truly exogenous in the model, while $t_i$ is interesting to get a sense of the precision of the model. If it is opened up for neutrals to generate income and this income to be distributed as seen fit by the association, the variable $d_i$ is exogenous as well. Estimates of $d_i$ have been provided in chapter 3.

Graphing the values of the estimates for the variables gives some interesting insight. Graphing $\mu_{est}$, i.e. the estimate for the number of dedicated fans for instance looks like this
Remembering that the estimate is found by the number of fans that attend games, the graph shows the sum of the averages over all clubs. This shows a clear downwards trend, meaning stadium attendance in Tippeligaen is falling. As the league got expanded from 14 to 16 teams starting in 2009, a more precise average would be to divide the sums with the number of clubs, giving the average attendance to a single club’s home game. Since there is one home game for every away game this will also be the average attendance to a game in Tippeligaen.

Figure 5  Average stadium attendance
Doing this, the trend becomes even clearer, as the average number of attendees to a game is decreasing every year with one exception (attendance increased from 2013 to 2014). It should be noted that part of the decrease from 2014 to 2015 can be explained by Mjøndalen being promoted at the expense of Brann, i.e. a club with very low attendance numbers replaced one with very high attendance numbers. However, since 2008, attendance is down by $1/3$, something that can probably not be explained by coincidence alone.

The model suggests that utility for dedicated fans and couch potatoes is inversely linked. While dedicated fans get utility from their team being dominant, neutrals prefer competitive balance. If dedicated fans are failing the clubs, a possibility is that their requirements are not being met, i.e. they receive too little utility. Stated differently, dedicated fans may feel alienated because the association is focusing too much on competitive balance. In this case, one would expect a rise in the number of couch potato viewers, that is, the number of viewers on public networks. The estimate for $\theta$, $\theta_{\text{est}}$ is based on this number. Graphing it, the following trend becomes clear:

![Free broadcast viewership graph](image)

**Figure 6 Free broadcast viewership**

This shows signs of the same tendency as the dedicated fans, namely that they are disappearing. It is important to specify that the number of games available on public networks varies over time. The number of games available on public broadcasting was around 90 in the
time period 2009-2012, before dropping to roughly 60 since 2013 (a reduction of 1/3).
Correcting for this, a more precise graph looks like this;

![Graph showing average free broadcast viewership](image)

\textit{Figure 7} \hspace{1cm} \textit{Average free broadcast viewership}

Here, the total number of viewers is divided by the number of publicly broadcasted games, giving average number of viewers for a game. The same pattern as stadium attendance becomes clear. In fact, the figure is very similar to the figure showing average stadium attendance. The observations for $\theta$ and $\mu$ give a correlation coefficient of $R=0.965$, which is remarkably high. This gives an indication of a trend where both dedicated and neutral fans are losing interest in Tippeligaen. Incidentally, the correlation between the total number of public TV-viewers and the number of games publicly broadcast is “only” at 0.644, which, assuming causality works from games broadcast to number of viewers, indicates that while the number of games broadcast has some explanation power as to why neutrals are losing interest, there are other factors affecting this as well.

To get an idea of which type of viewers is disappearing faster, one can calculate the percent-wise change from year to year. Doing this, using average attendance in stadiums and average viewers to publicly broadcasted games reveals the following graph;
Relative fall in attendance, dedicated and couch potatoes

Here, the attendance for both categories of fans is given a reference value of 100 for the 2008 season. One sees that neutral fans are leaving at a much higher pace than dedicated fans. This insight will have important implications in the discussion.

Finally, one can look at the total value of squads, that is, sum the value of the squads over all teams, and look if there are any trends there.

Aggregated squad values
The trend is more ambiguous than with the other estimates, but seems to be somewhat opposite as the other two variables, that is, the squads have increased in value. Plotting the graph for average squad value gives

![Graph showing average squad values from 2008 to 2015]

**Figure 10  Average squad values**

This is very similar in shape. The squad values thus do not seem to follow the same trend the other two variables.

Another point that might be of some interest is finding the standard deviations of the different data. Specifically, an interesting point is the standard deviation of the squad values, since this says something about the degree of competitive balance. As mentioned, there is not enough data to compute the standard deviation of the TV-viewers, but a calculation of standard deviation of average attendance is included in the table below. Standard deviations are found by looking at differences between clubs in the same year, eliminating any time effect. Since values for the entire population is available at every season, the formula for population standard deviation is used, \( \text{St.Dv} = \sqrt{\frac{1}{n} \left( \sum_{i=1}^{n} X_i - \mu \right)^2} \)
### Table 2  Standard deviations of the estimates

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>St.dv</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>squad</td>
<td>4.49</td>
<td>5.65</td>
<td>5.67</td>
<td>3.37</td>
<td>4.66</td>
<td>5.93</td>
<td>5.82</td>
<td>4.20</td>
</tr>
<tr>
<td>value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. dv</td>
<td>4487.91</td>
<td>3840.45</td>
<td>3984.27</td>
<td>3410.12</td>
<td>3256.73</td>
<td>3321.92</td>
<td>3168.48</td>
<td>3684.83</td>
</tr>
</tbody>
</table>

The standard deviation for squad values across seasons seems pretty well behaved, with certain ups and downs; the standard deviation of the match attendance shows some signs of falling. This means of course, that attendance has become more equal between teams in recent years (bar 2015). Knowing this, and that the overall attendance is falling, attendance across teams shows signs of being more equal when attendance is low. This might be an indication that supporters, to a larger degree are failing the big teams, while attendance for smaller teams is more stable. However, the dataset is limited and one should be careful drawing conclusions.

### 5.1.3 Fitting data to the model

#### 5.1.3.1 Consumer utility

In the analysis, the model will be taken at face-value. That is, the mechanisms outlined in the model will be assumed to be real and accurate. This is a very strong assumption, and potential weaknesses have been discussed in the theory chapter. The simple version of the model, as presented in the theory section, had quite large limitations. Towards the end of the section possible ways to expand the model to gain some realism was explored.

The main concern is to find a way to measure utility for the consumers. Utility was given as

\[ U = U_1 + U_2 + \Theta w_1 w_2 \]  

(3)

The main challenge lies in applying this to more teams. A strong but very useful assumption, that has already been discussed, is to assume that all matches are independent of each other in every way. That is, a match between team i and team j has no effect what so ever on team h and their fans. This assumption is strong because it seems unrealistic. If one thinks of rivalries and competitiveness, supporters of a team not directly involved in a match may easily have
preferences over the outcome. This would require much more work in coding the data however, and is far outside the possibilities of this thesis. By assuming internal independence between the matches as indicated above, measuring utility becomes quite simple, using tools from linear algebra.

The data provides the luxury of having two ways of determining utility. One can fill in the estimates for the variables in the model, or one can simply look at the results as they happened in real life. The difference may be substantial. This means that there might be a lot of noise that the model does not account for. The outcome of the model is thus at best a prediction, where the winning fraction of a team versus another is defined as

\[ w_{i,j} = \frac{t_i}{t_i + t_j} \]

While the prediction might be a good one, it is obvious that the actual results better reflect reality. Due to this I will regard the predictions of the model as ex-ante, and the actual outcome as ex-post. In the ex-post analysis the results for the winning ratios are not predictions but perfectly correct.

Applying the assumptions above, the ex-ante (or predicted) utility of any game can now be found using the following formula

\[ U_{i,j} = U_i + U_j + \Theta w_i w_j , \]

which following the model can be rewritten as

\[ U_{i,j} = \mu_i \frac{t_i}{t_i + t_j} + \mu_j \frac{t_j}{t_i + t_j} + \Theta \frac{t_i t_j}{(t_i + t_j)^2} \]

This includes only variables that there exist estimates for. Looking at how leagues are played, one knows that the term \( U_{i,j} \) can be split further, assuming it consists of two matches, one at home and one away for both teams. If it is assumed that dedicated fans attend home games only, which can be a somewhat strong assumption, but not extreme, considering the large geographical differences in Norway, a new assumption is that dedicated fans only derive utility from home games, while neutrals get utility from both games by watching TV. The term can thus be stated as

\[ U_{i,j} \mid \text{home game } i = \mu_i \frac{t_i}{t_i + t_j} + 0 + \Theta \frac{t_i t_j}{(t_i + t_j)^2} \]
\[ U_{ij} = 0 + \mu_j \frac{t_j}{t_i + t_j} + \Theta \frac{t_i t_j}{(t_i + t_j)^2} \]

Here dedicated fans only derive utility from home games. While this simplification might seem very strong, it has no effect in reality, as it is a mere simplification allowing for easier terms when calculating the utility. One could find utility by specifying utility for home supporters, away supporters and neutral in all games, but since every home game has a counterpart in an away game, this simplification allows to only count every team once instead of twice. This allows for an easy calculation of total utility over an entire season, by simply summing up the terms,

\[ U = \sum_{i=1}^{n} \mu_i \left[ \sum_{j=1}^{n-1} \frac{t_i}{t_i + t_j} + \Theta \frac{t_i t_j}{(t_i + t_j)^2} \right] \]

Where the internal summation is done from 1 to n-1 to reflect the fact that a team does not play itself. Total utility can this way be found easily by arranging this term as a 16x16 matrix and summing over all cells.

Finding the ex post utility is much simpler, but relies on some assumptions as well. Firstly, calculating utility for all games individually is a long and tedious process, and time does not allow it. However, utility can still be found using the final results of a season. A teams winning ratio can be found by dividing points scored \((P_i)\) by the total possible point tally \((P_{\text{max}})\). This ratio can then be used to find total utility for team \(i\), by multiplying with the fan weight and the number of home games \((h)\), \(\frac{P_i}{P_{\text{max}}} \mu_i \times h\). As for the neutral fans, the term \(\Theta w_i w_j\) can be replaced by the average win fraction of team \(i\) and the average win fraction of all others, so \(\Theta \frac{P_i}{P_{\text{max}}} \frac{P_{\text{max}} - P_i}{P_{\text{max}} - P_i}\), which is then multiplied with the number of home games.

Summing over all \(i\)’s one gets the total realized utility.

The two previous formulas will be predicted and realized utility given the fan pools and talent pools provided. Since it is established that redistribution occurs, the formulas can be viewed as predicted and realized utility in a league system with redistribution. The model showed that clubs will optimize differently without redistribution. If one takes the total size of the talent pool as a given, but allow for the distribution of talent to change, one can get the talent pools for different clubs as would be under no intervention. These values can be used to calculate predicted utility under a free market paradigm. Calculations are done using the same formula as the predicted case, but \(t_i\) is replaced by \(t_i^*\) which, according to the model is equal to the
relative size of the talent pool, i.e. if team i has 1/5 of the fan base it also gets 1/5 of the talent
pool under free market conditions.

Finally, it is possible to calculate the maximum potential utility, the utility under optimal
conditions. Equation 4 from the theory section gives the optimal winning fraction as $w_i^O = \frac{1}{2} + \frac{\mu_i - \mu_j}{2\theta}$, and summing over all i’s and j’s, one can get the potential utility under optimal
conditions. Again, this is a strength of the linear set-up, as total optimization can be achieved
simply by optimizing each term individually. This can in turn be compared to the realized
utility to get a sense of the efficiency of the system.

Having these four sets of utilities opens many possibilities. In addition to the mentioned
efficiency calculations, one can also compare e.g. predicted utility with optimal utility, at a
game by game basis.

5.1.3.2 Investment profile

The model predicts that under regulation every club will have an optimal investment profile
such that equation 6 applies (changing the 0.5 term with 1/16 to account for more teams), if
income is divided equally amongst teams. The question that arises is what value the factor $k$
takes. From the model, $k$ is the discount factor put on neutral supporters to indicate that they
generate less income than the dedicated fans. From the data one can get estimates of all the
other variables as seen above. Calculating the predicted investment in talent under free market
assumptions is easily done by multiplying any team’s ratio of support with the aggregate
value of talent (done in table 3 below). Comparing this predicted value with the actual squad
value, one can assume that any difference occurs due to redistribution. This means that clubs
know that there will be redistribution, and their incentives change. The result is the actual
value of the talent that is observed. From the model one sees that this effect consists of adding
the term $\frac{1}{16}k\theta$ to both the nominator and denominator in equation (6’’). Thus, theoretically,
one should be able to find a value for $k$, since all else is known. Theoretically, one can also
choose arbitrarily which two teams to use to calculate $k$, due to the internal dependence in the
system. In practice however, it is quite complicated to do so. The reason is that a lot of noise
exists, making the predictions in the model quite inaccurate. A possible work-around is to
minimize the aggregated difference between the predicted and the observed values of t based
on the factor $k$. Doing this for a single club means aggregating the term in 6 for team i
against all other teams, for different values of k in a trial and error fashion. From the model it was assumed that k takes values between 0 and 1. An immediate problem that arises in this case is convergence. If one tries to find a value for k which fits one particular club, the sum will converge towards the limit values for k=1 or k=0. The problem is that even at the limits, the result might not be satisfactory. Another even more complicated problem is that even if one were to find a satisfactory value of k on the [0,1] spectrum, this will be a value for k found on the basis of 1 team. The factor k is supposedly constant across teams, but due to the aforementioned noise, the k found for one team might not fit for all the others. Thus to find a good estimate of k, one needs some principle in choosing which club to start with.

All in all, finding a value for k that explains every club’s investment decision, and that is constant across teams is complicated. An assumption that will make the analysis easier is simply acknowledging that the data provides too little information, and instead believe that clubs more or less optimize their investments.

5.1.4 Season summary

The fitted data can be displayed in a table as done below for the 2015 season. The weight of the couch potatoes is assumed constant across teams, and equal to the total number of views on public television divided by the total number of games. Dividing by the total number of games (instead of the number of games shown) is done to get an indication of the neutral interest in the average game. The estimates obtained for the µ’s and t’s are directly inserted in the table. Similar tables for the seasons 2008-14 are found in the appendix. Teams are sorted decreasingly according to average home attendance.
Table 3  Summary, season 2015

<table>
<thead>
<tr>
<th>Team</th>
<th>Average attendance, home ($\mu_i$)</th>
<th>Ratio, attendance ($\alpha\mu_i$)</th>
<th>Squad value*</th>
<th>Ratio, squad value ($t_i$)</th>
<th>$\alpha\mu_i - t_i$</th>
<th>Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosenborg</td>
<td>18039</td>
<td>0,168003</td>
<td>20,25</td>
<td>0,132465</td>
<td>0,035538</td>
<td>Low</td>
</tr>
<tr>
<td>Viking</td>
<td>10278</td>
<td>0,095722</td>
<td>8,78</td>
<td>0,057434</td>
<td>0,038288</td>
<td>Low</td>
</tr>
<tr>
<td>Vålerenga</td>
<td>10099</td>
<td>0,094055</td>
<td>11,45</td>
<td>0,0749</td>
<td>0,019155</td>
<td>Low</td>
</tr>
<tr>
<td>Molde</td>
<td>8951</td>
<td>0,083364</td>
<td>16,95</td>
<td>0,110879</td>
<td>-0,02751</td>
<td>High</td>
</tr>
<tr>
<td>Odd Grenland</td>
<td>7911</td>
<td>0,073678</td>
<td>11,05</td>
<td>0,072284</td>
<td>0,001394</td>
<td>Low</td>
</tr>
<tr>
<td>Strømsgodset</td>
<td>7030</td>
<td>0,065473</td>
<td>14,5</td>
<td>0,094852</td>
<td>-0,02938</td>
<td>High</td>
</tr>
<tr>
<td>Aalesund</td>
<td>6695</td>
<td>0,062353</td>
<td>9,35</td>
<td>0,061163</td>
<td>0,00119</td>
<td>High</td>
</tr>
<tr>
<td>Start</td>
<td>6155</td>
<td>0,057324</td>
<td>5,45</td>
<td>0,035651</td>
<td>0,021672</td>
<td>Low</td>
</tr>
<tr>
<td>Lillestrøm</td>
<td>5527</td>
<td>0,051475</td>
<td>6,08</td>
<td>0,039772</td>
<td>0,011702</td>
<td>Low</td>
</tr>
<tr>
<td>Haugesund</td>
<td>5386</td>
<td>0,050162</td>
<td>10,03</td>
<td>0,065611</td>
<td>-0,01545</td>
<td>High</td>
</tr>
<tr>
<td>Sandefjord</td>
<td>4125</td>
<td>0,038417</td>
<td>5,1</td>
<td>0,033362</td>
<td>0,005056</td>
<td>Low</td>
</tr>
<tr>
<td>Stabæk</td>
<td>3880</td>
<td>0,036136</td>
<td>8,1</td>
<td>0,052986</td>
<td>-0,01685</td>
<td>High</td>
</tr>
<tr>
<td>Sarpsborg 08</td>
<td>3870</td>
<td>0,036043</td>
<td>6,2</td>
<td>0,040557</td>
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<td>Tromsø</td>
<td>3635</td>
<td>0,033854</td>
<td>9,05</td>
<td>0,059201</td>
<td>-0,02535</td>
<td>High</td>
</tr>
<tr>
<td>Bodø Glimt</td>
<td>3184</td>
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<td>6,55</td>
<td>0,042847</td>
<td>-0,01319</td>
<td>High</td>
</tr>
<tr>
<td>Mjøndalen</td>
<td>2608</td>
<td>0,024289</td>
<td>3,98</td>
<td>0,026035</td>
<td>-0,00175</td>
<td>High</td>
</tr>
<tr>
<td>Sum</td>
<td>107373</td>
<td>1</td>
<td>152,87</td>
<td>1</td>
<td>0,001*</td>
<td></td>
</tr>
</tbody>
</table>

*Value given in millions of euros
**Value is non-zero due to rounding off
***All values correct as of 26/12-15

In the table the term $\alpha\mu_i - t_i$ captures the difference between the attendance ratio and talent ratio for all the clubs. The model assumes these two to be equal under free market conditions. This means that if the model predicts with absolute accuracy, as is presumed, a negative value in the second to last column will indicate that the team is a net beneficiary of redistributive measures, while a positive value indicates a net contributor to redistribution. Looking at the table, an interesting fact is that there seems to be a tendency of larger clubs being net contributors and smaller teams being net beneficiaries. Looking at the tables for foregone seasons, one sees the same tendency here, bar some obvious instances of large clubs having even larger talent pools.
5.2 Analysis

In this section the data estimate above will be used to look at total utility gained by the supporters. Utility is found by using the terms for this, given in equations (1)-(3) in chapter 4. A summary for utility for the 2015 seasons is given in the following table.

Table 4 Utilities, season 2015

<table>
<thead>
<tr>
<th></th>
<th>P(U)</th>
<th>U</th>
<th>P(Uₘ)</th>
<th>U⁰</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.92 x 10⁶</td>
<td>2.83 x 10⁶</td>
<td>2.83 x 10⁶</td>
<td>3.08 x 10⁶</td>
<td>92.07%</td>
<td></td>
</tr>
</tbody>
</table>

Here, the first column is the predicted utility, given the allocations of μ, or the ex-ante utility. The second column is the realized utility, based on the actual results. The third column is the predicted utility if clubs were to optimize with regards to their own fans only, that is, the utility without outside regulation, or the predicted market outcome utility. The fourth column gives the potential utility, that is, the utility if all matches were optimized, according to equation 4. The final column gives the efficiency as a percentage, and is found by dividing U with U*.

The analysis reveals predicted and ideal winning ratios between every pair of teams for the entire season. This is what is used to get values for the utility. The winning ratios can also be displayed graphically, e.g. by taking the average winning ratio of all teams in a season, using the different measures. This is done below for the 2015 season, and for all prior seasons in the appendix. For simplicity, the winning ratio of a team is simply the average against all other teams. The measurement is thus prone to problems like outliers, since the distribution is not symmetrical around the mean. Still, some general observations can be made.

A final interesting point is found by looking at the winning ratios of all the teams. If one finds the dispersion from competitive balance of all winning ratios in a season, found by subtracting 0,5, one can say something about the way redistribution must go to improve welfare. 0,5 corresponds to perfect competitive balance, and is thus standardized to a nil-value. The winning ratio of any team lies between 0 and 1, so using absolute values, the dispersion should lie between 0 and 0,5. This dispersion can be found for the actual, the predicted and the ideal results. To get a sense of the league as a whole, one can sum the dispersion for all teams, as is done in the table below
Since the dispersion takes values between 0 and 0.5, the total dispersion, when summed for all 16 teams, takes values between 0 and 8, where a 0 value indicates perfect competitive balance. Here, the ideal value can be interpreted as the aggregated demand for competitive balance by the fans. Comparing this with the predicted and actual dispersion says something about why the system is not ideal, i.e. if it's because there is too much or too little competitive balance.

### 5.2.1 Reliability and validity

A reasonable question to ask is if the predicted utility is a good, consistent estimator for realized utility. It is important to remember that $P(U)$ is calculated using the mechanisms described by the model, which may be false, and that it’s statistical consistency and unbiasedness is not accounted for. As such, $P(U)$ is more of a parameter of prediction, using
the mechanisms described in the model. The parameter is in any case only off by about 2%, and as such must be seen as a decent prediction.

Another interesting aspect of the table is that the system seems to run very efficiently as is. That is, there is not much room for improvement. This might also seem strange, given that the model predicted conflicting interest between teams. However, a potential explanation is that the residual utility is very high. That is, a lot of utility is constant and bound by structural conditions. This means that even the most socially undesired outcome would gain the consumers quite a bit of utility. Notice that the model implicitly assumes that there is no disutility, meaning that consumers are always at least weakly better off than non-consumers.

6 **Discussing the results**

6.1 Comparing different outcomes

The discussion section will start by comparing the different outcomes. From the analysis, four different outcomes have been calculated; predicted outcome, according to the model; predicted outcome under free market conditions; actual outcome, based on the results; and ideal outcome, i.e. the allocation that maximizes social welfare.

6.1.1 Comparing predicted outcome and optimal outcome

Comparing predicted outcome with optimized outcome, a clear pattern becomes evident. The outcome predicted by the model has less competitive balance than the optimal outcome. This means that even with redistribution, the model expects the system to miss optimality by quite a bit. This is true for all eight seasons. A common trait is that the system misses optimality due to too little competitive balance, and not too much. The single team “responsible” for most of the dispersion from optimality is undoubtedly Rosenborg, who has more than the ideal concentration of talent in every season except 2015. Granted, optimality is hard to reach, and some clubs will have more than ideal talent and others less, but Rosenborg is consistently the club with the biggest or second biggest dispersion in talent from optimality. In five of the eight seasons, Rosenborg has the biggest positive dispersion from ideal concentration of talent. Two other clubs who has recently experienced a large positive dispersion from
optimality are Molde and Strømsgodset. Other big clubs tend to have more than optimal talent less consistently, such as Vålerenga and Viking. In these two cases, the talent is more than optimal about half of the time, but has recently been less than optimal. At the other end of the spectrum, the smaller clubs almost always have too little talent. These are clubs such as Sarpsborg 08, Sandnes Ulf, Hønefoss, Songdal, Bodø Glimt, Tromsø and Start. Incidentally, many of these are also clubs who have moved between tiers quite frequently in the time observed. This might explain why these clubs have a less than ideal concentration of talent. The system of promotion and relegation means that relegated clubs receive less broadcasting income in the lower tier. As seen in the revenue sharing algorithm, the second tier, OBOS-ligaen receives less than ¼ of the broadcasting money received by Tippeligaen. Being relegated, and losing income might therefore lead to less investment in talent, and frequent movement between tiers might make long term employment of expensive talent too risky for the clubs. Despite talent being more concentrated than ideal in the large clubs, there is no apparent trend showing that this concentration is increasing. This means that there doesn’t seem to be any strong, current mechanism working where the big gets bigger and the small gets smaller. Such a mechanism might have happened previously however.

6.1.2 Comparing predicted outcome and actual outcome

Another interesting observation arises from the difference between predicted and actual outcome. If one calculates an predicted point tally based on the concentration of talent, generally, one finds that teams with more talent are less dominant in practice than what would be predicted. That is, there is a general tendency of the league being more balanced than what would be predicted ex-ante. This is true in 5 of the 8 seasons looked at. This probably explains why actual utility generally seems to be higher than what one would expect; the actual results are closer to the very equal social optimal point than the predicted utility is.

An interesting question is why this is the case. From the model it was assumed that talent is the only factor of production for clubs. It was also shown that talent had decreasing returns to scale. An implication of this is that there will be some competitive balance. However, the equation for winning ratio might undervalue the size of the decreasing returns to scale. A way to improve this is to introduce a power \( \alpha \), so that the winning ratio instead is given by

\[
W_i = \frac{t_i^\alpha}{t_i^\alpha + t_j^\alpha}
\]
In the original equation, one sees that $\alpha$ is implicitly set to 1. The model can be adjusted by changing the factor $\alpha$. Specifically, if one changes $\alpha$ so that $\alpha < 1$, the marginal production of a unit of talent decreases. This means that competitive balance will improve, which as seen is often the case in reality.

If $\alpha$ is increased to values higher than 1, one will begin to see that the production function, $w_i$, is convex in certain areas, meaning that increasing $t_j$ by $h$ may actually increase $w_i$ by more than $h$. Finding the right value of $\alpha$ can be done by simply trying different values, until one finds the value that minimizes the difference between the predicted and actual results. As stated, a value for $\alpha$ of less than 1 will probably improve the model. A graph of the winning ratio with different values of $\alpha$ is presented below:

Figure 12  Alternative specifications for returns to scale.

Here, $t_j$ is set to 10, while $t_i$ varies according to the x-axis. The value of $\alpha$ is indicated on the right. One sees that the results are equal at $t_i=10$, at $w_i=0.5$. As discussed, one can also see areas of the function which are convex for $\alpha > 1$. Finally, one sees that for $\alpha < 1$, there is more competitive balance than for $\alpha=1$. This shows that if $\alpha < 1$, the results will be more equal. Given what has been observed in the data, introducing an $\alpha < 1$ might get more precise predictions.
6.1.3 Comparing predicted outcome and predicted outcome under free market conditions

Looking at the predicted concentration of talent under a free market for the seasons, one sees a tendency of some of the bigger clubs actually having more talent than what one would expect under free market conditions. This also explains why the predicted utility under free market conditions is significantly higher in certain years than the predicted utility with regulation; the free market prediction is actually more balanced than the predicted utility these years. On the basis of this one could believe that adapting a more laissez-faire approach might actually increase social utility, by improving competitive balance. This seems farfetched however. If one looks at for instance Spain, where there is a strong emphasis on laissez-faire, there is, as has been pointed out earlier, tendencies of big clubs getting relatively bigger. It should also be noted that the free market allocation is less efficient than the predicted allocation with regulation in recent years. That means that regulations seem to have worked the way the model predicts them to work in the last four seasons. Rosenberg provides an outlier here, as they consistently have more talent under regulation than what the model predicts under a laissez-faire policy.

The unexpected results of free market conditions improving competitive balance in certain cases, may simply be a result of poor modeling. Two assumptions made in the model might explain why the free market allocation behaves differently than predicted;

Firstly, the incentives of the clubs may be wrong. The model assumes profit maximizing, and this might be wrong. If clubs in reality maximize their wins, one would expect the ideal allocations under free market conditions to be different than the ones observed.

Another important factor, that is not accounted for in the model is alternative sources of income. Some sources like income generated through participation in European competitions, are often acquired by the bigger clubs, who have a high concentration of talent. Since clubs like Rosenberg and Molde have recently had this extra source of income, they can outspend other clubs, and spend more than their fan base suggests. This combined with the assumptions regarding incentives could explain why Rosenberg and Molde pretty consistently hire more talent than what free market conditions would dictate.
6.1.4 Comparing actual outcome and ideal outcome

Although efficiency is indeed very high, there is still room for improvement. As was shown in the model, an efficiency of 100% is only possible at the Kaldor-Hicks optimal allocation, which is unique. For every season, the outcome does not satisfy the Kaldor-Hicks criterion because there is too little competitive balance. Having a more equal redistribution of talent would improve the total utility, meaning that utility gained by neutrals could compensate any loss in utility experienced by dedicated supporters. The model suggested that social welfare will not be maximized due to clubs not accounting for neutral utility. Redistribution of talent can as seen act as a tool that will increase social welfare. When the data shows that redistribution does not lead to social optimum, one can therefore assume that the mechanisms are not strong enough, and that more talent should go to smaller teams in order for utility to increase. Possible policies to ensure this are discussed below.

6.1.5 Comparing several measures

An easy way to get a good overview of the season is summing in a graph, such as figure 11. Here, winning ratio is presented for all teams. The three different measures look at the ideal winning ratio, the actual winning ratio and the predicted winning ratio of the model.

Generally, one sees that the actual winning ratios for the larger teams are higher than ideal. Meanwhile the smaller teams generally have fewer wins than ideal. Meanwhile the trends for predicted results are not as strong, but generally, one can see the same results, the smaller teams have less than ideal talent, while the larger has more than ideal talent. Also interesting is the table of dispersions (table 5). If indeed the optimal allocation requires more competitive balance, one would expect this dispersion to be smaller than the others. From the table one sees that that is the case. Looking in the appendix one can also see that the ideal dispersion is lower than the actual and predicted dispersion for all seasons.

This strengthens the belief from earlier, namely that the loss of efficiency observed across all seasons is due to too little competitive balance. Also interesting is to see that all dispersions, ideal, predicted and actual have increased over the time horizon. Thus, there are indications that the league has become less balanced as time has progressed, however, this has not affected utility to a large extent, because the aggregated demand for competitive balance has fallen.
6.1.6 Summary of the results of the analysis

Briefly, the most important results of the analysis are the following:

- The efficiency for a given amount of talent is high, but no season is fully efficient.
- The inefficiency stems from too little competitive balance. Specifically, certain clubs tend to have too much talent for the social welfare. In the later seasons these clubs are Rosenborg, Molde and Strømsgodset, all located in the upper cohort of talent concentration and fan base size. The smallest clubs are the ones whose talent needs a large increase to improve competitive balance. These small clubs are often subjected to relegation and promotion, and are also often located in geographically remote areas. Higher efficiency can be attained through more redistribution. The large clubs Viking and Brann also needs a higher concentration of talent to bring the system to optimum.
- Competitive balance has actually decreased as time progresses. However, this does not have a large effect on the efficiency, because the aggregated demand for competitive balance has decreased as well, keeping efficiency more or less stable in the low 90% region. The reason for the reduced demand of competitive balance is the decline in interest from couch potatoes.
- The suggested market allocation of talent would in some cases (2008-2011) actually improve competitive balance from the real distribution, most likely do to larger clubs having alternative sources of income like money from European tournaments, and wrong assumptions regarding incentives. However, in the last four seasons the allocation of talent with redistribution is more balanced than the predicted free market allocation. Removing certain outliers, the general trend is in all cases that the big clubs finance the small clubs through redistribution.
- The realized utility is in most cases higher than the predicted utility, since the realized results are generally more balanced than predicted. This is an indication that the marginal production of an extra unit of talent is overestimated.

6.2 Possible policies to improve efficiency

This paper has assumed that there is some central governing agency who acts as a social planner when redistributing broadcasting revenue, so as to maximize overall utility. This might be a wrong assumption however. The redistribution of broadcasting money is, as stated,
done by NTF, which is a special-interest organization for the clubs themselves. This means that the clubs in reality are self-governed, and any redistribution of broadcasting income comes from the wishes of the clubs themselves. The NTF is therefore unlikely to act as a social planner, and will instead act according to the wishes of the clubs. It can be assumed that the allocation of talent is not in optimum because the clubs and by extension NTF does not fully incorporate neutral preferences in their decision making. Still, forcing redistributive policies on the clubs might increase social welfare.

Earlier in the paper, several existing and suggested policies have been examined. These include measures taken in American sports, like wage caps, revenue sharing and redistributive measures in talent allocation and policies suggested in football, such as financial fair play. Using common sense one can predict potential effects of such policies, and see if these effects are socially desirable.

An American styled wage cap is a flat, absolute amount equal for all clubs. Introducing a wage cap in Tippeligaen would most certainly affect the bigger clubs to the largest extent. This might improve competitive balance by creating a more equal distribution of talent across teams. Looking at the analysis, this would be a largely desired effect from a social point of view, and would probably represent a Kaldor-Hicks improvement for the league system. This would also potentially affect the equilibrium wage for the talent, by indirectly imposing an individual maximum wage of sorts.

Revenue sharing is, as has been seen already, done extensively in Tippeligaen. There are four sources of revenue that clubs retain for themselves more or less entirely, however: sponsorships, gate revenue, merchandise revenue and revenue generated through European competitions. Pooling all revenue and redistributing it equally would in theory ensure perfect competitive balance. However it would also likely come with undesired side effects, such as undermining incentives to compete and make money for the clubs. However, a large potential source of inequality lies in money made from participating in European tournaments. If money earned from European tournaments were to be divided between the clubs, one would restrict a potential source of growing inequality. However, it can also be argued that clubs that receive income from European participation will experience a higher cost of hiring talent, as other clubs will be aware of the extra assets. This could in itself create a trickle-down effect, where large clubs who receive money from European tournaments purchase players from other local clubs, distributing money downwards in the system.
Redistribution in talent: A final option which has been practiced in American sports is redistributive means in the talent, more specifically new talent that enters the market. This seems farfetched however, as it would probably be at odds with the Bosman-ruling.

A major problem with applying American-type regulations in Tippeligaen is that the regulations are designed for a system that exists in a vacuum. The governing body will in this case have monopoly power, and imposing e.g. wage caps will not affect the amount of talent, as players have no option but to accept the regulations. Tippeligaen is, however, only one competition in an open market that gives more bargaining power to the talent. Imposing strict regulations could thus lead to a competitive disadvantage for the entire league, causing a brain drain, where talent moves to a league that is able to offer superior conditions. American type regulations will therefore have to be imposed on more leagues to have the desired effect, which would require substantial co-operation between several associations. As the model shows, policies would also need to be designed to reflect fundamental realities in the league, such as distribution of fans and weight of neutrals. These factors are however, not equal across countries, making a single unified redistributive policy hard to implement in practice.

A version of financial fair play seems like a liable option however. Financial fair play would commit clubs to austerity, by putting a cap on the amount of deficit a club is allowed to run. A version of this already exists in Norwegian football through the license scheme. A key difference is that the current scheme allows potential negative equity to be covered by credit (specifically credit issued by shareholders), something the financial fair play scheme does not allow. An effective enforcement of this type of scheme would thus force clubs to only spend generated revenue (often called relevant revenue). If the larger clubs finance investment with credit to a larger extent than small clubs, this type of scheme would dampen overinvestment by large clubs, which could better competitive balance.

A final option is looking at the division regime currently implemented. As seen in the revenue sharing flow chart, 50% of the broadcasting revenue is divided according to final placement on the table. The model predicts a causal relationship from fans to talent and from talent to placement. This relationship has not been tested, but assuming it is true, competitive balance could be improved by dividing this share more equally. A possible drawback of this is that it might undermine incentives for clubs to compete athletically. Also, as seen in the data, the size of a clubs talent pool does not always match its fan base. If less broadcasting income was awarded based on athletic merit, and more income was awarded based on match attendance,
the system could be brought closer to the market outcome. However, it has also been shown that this outcome is often not desirable. Still, a general trend among the big clubs for all seasons is that Rosenborg, Molde and Strømsgodset have more talent than ideal, while Brann, Viking and to a certain extent Vålerenga have less talent than ideal. Some internal redistribution among these, large teams might thus improve the social welfare.

It is also important to remember that the data shows trends of declining demand for competitive balance. At the same time, the current scheme seems to weaken competitive balance at such a pace that the total utility is kept more or less constant. A policy designed to keep the current competitive balance constant for a limited time period, followed by a continuation of the current scheme, might therefore have a good effect, by bringing the system closer to optimum in the freezing face, and then let competitive balance decrease with the demand. This requires that both the demand and the actual results continue in the fashion seen.

### 6.3 Weaknesses of the analysis

The analysis has a very high aggregated demand for competitive balance, due to the high weight given to neutral supporters. A possible fix to this would be a re-parameterization of neutral utility. Neutrals might not extract the same amount of utility from a favorable result as dedicated supporters. The somewhat abstract concept of utility means that this is hard to check. Yet, if the model does in fact overestimate neutral utility, social welfare would be maximized through less competitive balance than the social optimum found in the analysis. This means that the current outcome might be more efficient than what is found in the analysis.

Other flaws with the analysis also stems from the simplicity of the model. Examples of simplistic assumptions include the constant marginal cost for talent and the mutual independence between games. These simplifications have none the less been crucial in making the analysis possible within the scope of this thesis. It is also important to remember that a model is always a trade-off between realism and simplicity, where if one aims for maximum realism, the results will become extremely hard to interpret.

Another potential weakness is the validity of the data. To get estimates for the variables of interest, several assumptions have been made. These assumptions means that what one
measures might not in fact be what one wishes to measure. However, looking at the values used to find the estimate, they certainly reflect the desired values at least to a certain degree. The problem in finding good enough data comes from the fact that this data does not exist in a fully coded set, ready for analysis, and coding the data would require work outside the scope of the thesis. Further exploring the questions raised in this thesis could benefit from a meta-analysis of the variables themselves, in order to address their validity.

7 Conclusion

In this thesis I have looked at the division of revenue for clubs in the Norwegian Tippeligaen to ask whether this leads to a socially optimal distribution of talent. The utilized model predicts that the socially optimal allocation of talent will not be reached because the clubs do not have strong enough incentives to aim for this particular allocation.

I have used data provided through three different sources in order to apply the model to reality. This data agrees with the model’s predictions, showing that in particular, historically successful teams, or teams with access to a good line of credit, tend to have a larger investment in talent than social optimum. The analysis also reveals that the same clubs tends to have a larger investment in talent than what one would expect a profit maximizing club to have under free market conditions. This affects the smaller clubs, meaning that they have less than ideal talent. It would be in the social best interest to apply more redistribution towards smaller clubs, in order to increase competitive balance.

A large part of the inefficiency, at least more recently seems to stem from clubs Rosenborg, Molde and Strømsgodset having too much talent and Brann, Viking and Vålerenga having too little. Common for these clubs are that they are all among the bigger clubs measured in supporters, and they are all pretty consistently found in the top tier. A policy change that awards more broadcasting money based on attendance might thus help to bring these six clubs closer to the optimal allocation. Due to the large amount of dedicated supporters that these clubs represent, this might have a large positive effect overall.

It has also been showed that attendance both by dedicated and neutral supporter has fallen over the last years. This does not seem to have much of an impact on the efficiency of the
system however. A reason for this might be that neutrals have left faster, while competitive balance shows signs of decreasing, meaning that the results moves with the demand.

More extensive forms of redistribution, such as the schemes found in American sports will likely have undesired side effects, since Tippeligaen is part of an international labor market for talent. All in all, the redistribution in Tippeligaen must be said to function quite well, as the efficiency is generally in the low 90% range for the seasons looked at. As mentioned, an important reason for not reaching the optimal allocation is a large weight of neutral supporters, whose preferences are not fully accounted for by the clubs.

Despite the potential benefits of more redistribution, it is quite understandable if one does not wish to impose more regulations. On a global scale, Tippeligaen are among the league competitions with a high degree of redistribution. Even tighter regulations could act to undermine the incentives of clubs to do well, which in turn can reduce the overall amount of talent in the competition.

The analysis likely suffers from the small amount of data available, and the reliability of said data. Also the model used seems quite simple, and probably has limitations. Future research into the theme of this thesis should therefore focus on acquiring better data, and further develop the theoretical framework.
8 Appendix

Summary tables

Utility, seasons 2008-13

<table>
<thead>
<tr>
<th>Seasons</th>
<th>E(U)</th>
<th>U</th>
<th>E(U_M)</th>
<th>U*</th>
<th>Efficiency</th>
</tr>
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<tbody>
<tr>
<td>2008*</td>
<td>4.34 x 10^6</td>
<td>4.49 x 10^6</td>
<td>4.44 x 10^6</td>
<td>5.18 x 10^6</td>
<td>86.70%</td>
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<tr>
<td>2009</td>
<td>6.87 x 10^6</td>
<td>7.22 x 10^6</td>
<td>7.19 x 10^6</td>
<td>7.75 x 10^6</td>
<td>93.16%</td>
</tr>
<tr>
<td>2010</td>
<td>6.16 x 10^6</td>
<td>6.44 x 10^6</td>
<td>6.34 x 10^6</td>
<td>7.03 x 10^6</td>
<td>91.71%</td>
</tr>
<tr>
<td>2011</td>
<td>5.02 x 10^6</td>
<td>5.23 x 10^6</td>
<td>5.09 x 10^6</td>
<td>5.51 x 10^6</td>
<td>94.92%</td>
</tr>
<tr>
<td>2012</td>
<td>4.32 x 10^6</td>
<td>4.33 x 10^6</td>
<td>4.24 x 10^6</td>
<td>4.62 x 10^6</td>
<td>93.77%</td>
</tr>
<tr>
<td>2013</td>
<td>3.02 x 10^6</td>
<td>3.01 x 10^6</td>
<td>2.93 x 10^6</td>
<td>3.19 x 10^6</td>
<td>94.49%</td>
</tr>
<tr>
<td>2014</td>
<td>3.08 x 10^6</td>
<td>3.02 x 10^6</td>
<td>3.01 x 10^6</td>
<td>3.25 x 10^6</td>
<td>92.71%</td>
</tr>
</tbody>
</table>

*Last season with 14 teams.
Summary, season 2014

<table>
<thead>
<tr>
<th>Team</th>
<th>Average attendance, home ($\mu_i$)</th>
<th>Ratio, attendance ($\alpha\mu_i$)</th>
<th>Squad value**</th>
<th>Ratio, squad value ($t_i$)</th>
<th>$\alpha\mu_i - t_i$</th>
<th>Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosenborg</td>
<td>13915</td>
<td>0,124939</td>
<td>23,15</td>
<td>0,143415</td>
<td>-0,018475</td>
<td>High</td>
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<td>Brann</td>
<td>11991</td>
<td>0,107664</td>
<td>10,5</td>
<td>0,065048</td>
<td>0,0426166</td>
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<tr>
<td>Viking</td>
<td>10011</td>
<td>0,089886</td>
<td>8,65</td>
<td>0,053587</td>
<td>0,0362994</td>
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<td>Vålerenga</td>
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<td>8,93</td>
<td>0,055322</td>
<td>0,0322662</td>
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<td>9243</td>
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<td>25,55</td>
<td>0,158283</td>
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<td>Aalesund</td>
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<td>0,068248</td>
<td>9</td>
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<td>Odd Grenland</td>
<td>7156</td>
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<td>8,2</td>
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<td>Strømsgodset</td>
<td>6708</td>
<td>0,060229</td>
<td>14</td>
<td>0,08673</td>
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<td>Start</td>
<td>5962</td>
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<td>6,9</td>
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<td>9,6</td>
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<td>Stabæk</td>
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<td>6,4</td>
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<td>161,42</td>
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Neutral viewers total | Games broadcast | Games played | $\theta_{est}$
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<tr>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
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<tr>
<td>9 598 000</td>
<td>60</td>
<td>240</td>
<td>39 992</td>
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Measurement

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<tr>
<th>Sum of dispersion</th>
<th>Predicted</th>
<th>Ideal</th>
<th>Actual</th>
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<tr>
<td>1,314513644</td>
<td>0,5586684</td>
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### Summary, season 2013

<table>
<thead>
<tr>
<th>Team</th>
<th>Average attendance, home ($\mu_i$)</th>
<th>Ratio, attendance ($a_i\mu_i$)</th>
<th>Squad value**</th>
<th>Ratio, squad value ($t_i$)</th>
<th>$\alpha_i - t_i$</th>
<th>Investment</th>
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<tr>
<td>Rosenborg</td>
<td>14805</td>
<td>0.135521</td>
<td>26.38</td>
<td>0.131847</td>
<td>0.003674</td>
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<td>Brann</td>
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<td>10284</td>
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Summary, season 2012

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<th>Ratio, squad value ($t_i$)</th>
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Neutral viewers total | Games broadcast | Games played | $\theta_{est}$
15 080 000 | 90 | 240 | 62 833

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### Summary, season 2011

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<th>Ratio, squad value ($t_i$)</th>
<th>$a_i t_i - t_i$</th>
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Neutral viewers total | Games broadcast | Games played | $\theta_{est}$
--- | --- | --- | ---
18 163 000 | 91 | 240 | 75 679

Measurement | Predicted | Ideal | Actual
--- | --- | --- | ---
Sum of dispersion | 1,494253 | 0,333165 | 1,388889
### Summary season 2010

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<th>Ratio, squad value ($t_i$)</th>
<th>$\alpha_{\mu_i} - t_i$</th>
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## Summary season 2009

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<th>Ratio, squad value ($t_i$)</th>
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<td>-0.00872</td>
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</tr>
<tr>
<td>Bodø Glimt</td>
<td>4228</td>
<td>0.029496</td>
<td>2.05</td>
<td>0.020651</td>
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<td>4.43</td>
<td>0.044626</td>
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<table>
<thead>
<tr>
<th>Neutral viewers total</th>
<th>Games broadcast</th>
<th>Games played</th>
<th>$\theta_{est}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 667 000</td>
<td>90</td>
<td>240</td>
<td>111 113</td>
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<th>Ideal</th>
<th>Actual</th>
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<tbody>
<tr>
<td>Sum of dispersion</td>
<td>1.745157</td>
<td>0.237096</td>
<td>1.722222</td>
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## Summary, season 2008

<table>
<thead>
<tr>
<th>Team</th>
<th>Average attendance, home ($\mu_i$)</th>
<th>Ratio, attendance ($\alpha_i \mu_i$)</th>
<th>Squad value**</th>
<th>Ratio, squad value ($t_i$)</th>
<th>$\alpha_i - t_i$</th>
<th>Investment</th>
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<tr>
<td>Rosenborg</td>
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<td>0.138085</td>
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<td>0.165988</td>
<td>-0.0279</td>
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<tr>
<td>Brann</td>
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<td>0.123495</td>
<td>11.53</td>
<td>0.109175</td>
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<td>Viking</td>
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<td>8.75</td>
<td>0.082852</td>
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<tr>
<td>Vålerenga</td>
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<td>0.092508</td>
<td>16.4</td>
<td>0.155288</td>
<td>-0.06278</td>
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<tr>
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<td>0.034845</td>
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</table>

<table>
<thead>
<tr>
<th>Neutral viewers total</th>
<th>Games broadcast</th>
<th>Games played</th>
<th>$\theta_{est}$</th>
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<tr>
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<td>182</td>
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<td>1.510964</td>
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9 References


