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Domestic Violence and Football in Glasgow: Are Reference Points Relevant?

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Abstract

A growing body of evidence suggests that people exhibit loss aversion—the displeasure from suffering a loss is larger than the pleasure enjoyed from an equivalent-sized gain—and that expectations are important in determining what is perceived as a loss. Recent research suggests that disappointing results in sporting fixtures relative to pre-match expectations play an important role in triggering domestic violence (Card and Dahl 2011), consistent with the idea of loss aversion around expectations-based reference points. This paper seeks to investigate whether such behaviour is exhibited by football fans in Glasgow by looking at the relationship between match outcomes relative to expectations and levels of domestic violence using a data set that contains every domestic violence incident in Glasgow over a period of more than eight years. Whilst we find that when the ‘Old-Firm’ Glasgow rivals Celtic and Rangers play there are large increases in domestic violence (regardless of the outcome of the match), in other matches disappointing results relative to expectations are not linked to increased domestic violence, except when those matches occur at the very end of the season where the title is still being contended.

Key words: domestic abuse; loss aversion; Old Firm; reference points; Scottish football.

JEL classification: D03; J12.

Word count: 9,383 (including tables).

1 Introduction

It is clear that there is a link between professional sport and spectator violence. The most visible and notorious example of this is displayed in the behaviour of the football hooligan.¹ An arguably more perplexing manifestation of violence related to professional sport has been highlighted and has been attracting attention from the media, public policy makers and academics. This is the relationship between domestic violence and professional sport. It is more perplexing than hooliganism in that the violence is not committed in public against rival fans as an extension of the on-field rivalry, but behind closed doors against spouses and partners.

Perhaps the most high profile example of the link between domestic violence and football is in Glasgow and relates to the intense traditional rivalry between the ‘Old Firm’ of Celtic and Rangers. After an Old Firm match on Sunday September 18, 2011, domestic violence incidents in Glasgow more than doubled compared to a football-free Sunday.² In March 2011, the Scottish Government, the police and the Scottish football community formed the Joint Action Group (JAG) to “protect the good reputation of Scottish football and to contribute positively to efforts to tackle wider social issues—in particular alcohol misuse, violence and bigotry.” Tackling domestic violence was a centrally stated objective of the JAG report.³ At its simplest, it seems that engaging with a football match provides an emotional cue that results in an increased likelihood of domestic violence taking place. In this paper we focus on the relationship between the particular characteristics of football matches involving the Old Firm teams (both when they play each other and when they play other teams) and variation in the level of domestic violence.⁴

Academic attention towards domestic violence and professional sport has come in the form of [Card and Dahl \(2011\)](#). They conduct a study for the US and consider the link between domestic violence and (American) football. The authors adopt ideas embedded in prospect theory, as first presented by [Kahneman and Tversky \(1979\)](#), which hypothesises that individuals code outcomes as gains or losses relative to a reference point and exhibit loss aversion, in that a loss gives a greater disutility than the utility from an equivalent-sized gain. The theory has since been further developed to allow for the reference point

¹For a recent economic approach to hooliganism and law enforcement, see [Poutvaara and Priks \(2009a\)](#) and [Poutvaara and Priks \(2009b\)](#).

²See ‘Domestic abuse incidents double after Old Firm match’, *Daily Record*, September 19, 2011; ‘Domestic abuse incidents double after Old Firm game’, *The Telegraph*, September 20, 2011; ‘Warning over huge rise in Old Firm domestic abuse’, *The Herald*, September 20, 2011.

³See <http://www.scotland.gov.uk/Resource/Doc/925/0123798.pdf> for the Joint Action Group Progress Report, December 2011.

⁴[Finkel \(2007\)](#) discusses the psychological mechanisms that lead to domestic violence.

to be formed by expectations rather than simply being defined as the status quo (see, for example, [Kőszegi and Rabin \(2006\)](#)), and it is this that permits a clean application of prospect theory to the link between domestic violence and outcomes of sporting fixtures. [Card and Dahl \(2011\)](#) investigate whether domestic violence in cities in the US is associated with the features of the outcome of football games involving the ‘home’ team. They hypothesise that fans form expectations of their team’s performance in a game, that can be proxied by the pre-game betting odds, and evaluate the outcome of the game relative to those expectations. They find that in their sample as a whole domestic violence increases by approximately 10% following an unexpected loss. If the sample is split to distinguish between games where the team is in playoff contention or not, then in games where the team is still in playoff contention (which accounts for 68% of games in the sample) there is a 13% increase in domestic violence following an unexpected loss, but no significant effect of unexpected losses when the team is not in playoff contention. By contrast, they find that there is no increase in domestic violence associated with expected losses (or indeed a decrease in domestic violence associated with either unexpected or expected wins). This suggests that, in games that matter, experiencing an ‘upset loss’ provides fans with an emotional cue that causes them to commit greater than average levels of domestic violence.⁵

Recent experimental evidence in the context of a real effort competition supports the idea that individuals are loss averse around an endogenous expectations-based reference point ([Gill and Prowse 2012](#)). In a sporting setting [Priks \(2010\)](#) undertook a study of unruly fan behaviour in Sweden finding that it is the unfulfilled expectation of a good performance (using league position as a reference point) that leads to a significant increase in object throwing rather than bad performance *per se*. [Munyo and Rossi \(2013\)](#) investigate the relationship between property crime and unexpected outcomes in football in Uruguay (where expectations are taken to be proxied by pre-match betting odds), finding that when one of the two main Uruguayan teams unexpectedly lose (win) violent property crime increases (decreases) relative to when that match outcome was expected, suggesting the importance not only of the match outcome but also of fans’ expectations. However, they find no effect for non-violent property crime.⁶

The aim of the current study, which closely follows that of [Card and Dahl \(2011\)](#), is to understand whether reference-dependent preferences are relevant in

⁵Earlier work on American football and violence by [Gantz et al \(2006\)](#) and [Rees and Schnepel \(2009\)](#) does not investigate the potential role of reference points.

⁶[Kirby et al \(2014\)](#) investigate the link between World Cup football matches and domestic abuse in the North West of England, but whilst they consider different match outcomes, finding that there is a larger effect when England lost than when they won or drew, reference dependence is not considered.

explaining the relationship between football matches involving Celtic or Rangers and levels of domestic violence in and around Glasgow. We do this using data supplied by Strathclyde Police on all domestic violence incidents in and around Glasgow from January 1st 2003 until 5th October 2011, disaggregated by police subdivision, along with information on football matches and pre-match betting odds that are freely available on the web. We control for key factors (to be discussed later) and our main finding is that the traditional rivalry between the two teams is the main explanatory variable for domestic violence with regard to its relationship to football. In contrast to the results found in [Card and Dahl \(2011\)](#), in our full sample we find no statistically significant relationship between disappointing match outcomes and levels of domestic violence: Old Firm clashes (where all matches are expected to be close so no outcome is particularly unexpected) are strongly correlated with increases in domestic violence, but excepting these matches we find no statistically significant relationship between any match outcome and the level of domestic violence. If, in an attempt to isolate important matches, we restrict our attention to the last 10 games of the season where the team has a mathematical chance of winning the league (accounting for roughly 24% of matches in our sample) there is still no relationship between disappointing outcomes and levels of domestic violence. Only when we consider the last 5 matches of the season where the title is still being contested do we find a relationship between unexpected outcomes and domestic violence, but when doing so we are restricting our analysis to only 8% of the matches each team played during the sample period to focus on particularly salient matches. In contrast to the findings of [Card and Dahl \(2011\)](#), loss aversion seems not to be a general feature of the behaviour of Celtic and Rangers fans, but is exhibited only when the match is highly salient.

Understanding the precise nature of the link between football and domestic violence is important from a resource allocation point of view, and our quantitative evidence is informative in this regard. It would be easy to conclude, given the recent research that links unexpected losses with spikes in domestic violence coupled with the strong link between domestic violence and football in Glasgow (which triggered the JAG mentioned earlier) that when an Old Firm team loses unexpectedly one would expect an increase in domestic violence (which was our initial expectation) and that extra resources should be allocated to preventing domestic violence. However, our findings demonstrate that the relationship between professional sport and violence found by [Card and Dahl \(2011\)](#) (and also by [Priks \(2010\)](#) and [Munyo and Rossi \(2013\)](#)) is perhaps not easily extended to other sporting settings and so caution should be exercised in making this recommendation, except for those matches at the very end of the season where the title is still being contested.

The reason for this may be the strong local rivalry between the Old Firm teams, which might be thought of as the most intense sporting rivalry in the world (see the opening chapter in [Wilson \(2012\)](#)). Perhaps in the case of this Glasgow rivalry, the emotional salience surrounding this fixture is so intense (reflected in domestic violence), that the negative emotions that [Card and Dahl \(2011\)](#) find for unexpected defeats in the case of American football (reflected in domestic violence) are negligible (or at least, insufficient to trigger domestic violence) in the case of unexpected defeats for the Old Firm teams when playing matches against other rivals. In 2012 Rangers became insolvent and were relegated from the Scottish Premier League (SPL) to the fourth league tier of Scottish Football. Until they return to the SPL there will be no Old Firm clashes in the league. This ‘natural experiment’ will, after the passage of time, allow us to revisit the issue to investigate whether the pattern of domestic violence associated with football in Glasgow does change in the absence of Old Firm matches. The predicted reduction in domestic violence is a side-benefit of the very costly demise of Rangers. Given the positive effect to Scottish football and the economy ([Allan et al 2007](#)) of Old Firm matches, ideally a way can be found to minimise the scar of domestic violence upon these matches.

2 Data

Our data on domestic violence was obtained from Strathclyde Police which is responsible for the region of Strathclyde, populated by 2.3 million inhabitants, covering an area of 13,624 km² and containing the city of Glasgow with a population of approximately 600,000.⁷ The data contains, for each of Strathclyde Police force’s 30 subdivisions⁸ the number of incidents of domestic violence recorded on each day between 1st January 2003 and 5th October 2011 (a total of 3200 days). Our data is thus a panel with 30 police subdivisions and 3200 days. *All* incidents of domestic violence recorded by Strathclyde Police are included in the data. So that we are able to associate domestic violence incidents in the early hours of the morning with events that took place the day before we constructed the data so that a day in our sample period runs from 12 noon on the day in question until 11.59am the following day.

Figure 1 plots the aggregated data on domestic violence in Strathclyde and Table 1 presents the summary statistics for the data for various types of days. There is a general upward trend in the number of domestic violence incidents

⁷These details came from http://en.wikipedia.org/wiki/Strathclyde_Police and <http://en.wikipedia.org/wiki/Glasgow>, accessed 23/07/2013.

⁸On 1st April 2013, after our sample period, all police forces in Scotland came under the auspices of “Police Scotland”.

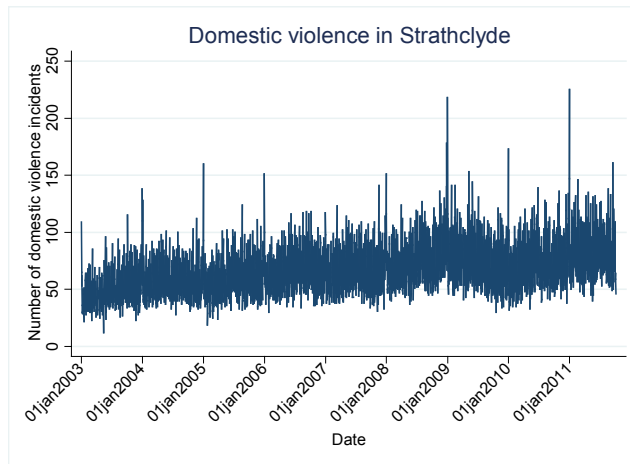


Figure 1: Domestic violence in Strathclyde as a whole.

reported,⁹ and there is considerable variation in the number of incidents of domestic violence across days of the week with a greater number of domestic violence incidents on average at the weekend. There is also a sharp rise in domestic violence around Christmas and New Year. In Table 1 we also include the level of domestic violence when Celtic and/or Rangers are engaged in football matches. These summary statistics tell us two things: a) the fact that domestic violence incidents increase on days when Celtic or Rangers play suggests the need for further investigation of the source of this increase; and b) when investigating this it is important to control for year, day of the week and Christmas holiday effects.¹⁰

We collected data on all Scottish Premier League (SPL) football matches that involved either Celtic or Rangers during the sample period¹¹ from information that is freely available on the Web.¹² Each year the SPL season runs from August to May. There are 12 teams in the league. The league has an unusual structure in that the year is divided into two parts. In the first part, each team plays each other 3 times. In the second, the league splits into upper and lower sections consisting of 6 teams in each. Teams then proceed to play one further game against each team in their section. This provides a total of 38

⁹This may be due to increased awareness or better reporting methods and not necessarily due to an increase in the number of incidents actually committed.

¹⁰Initial examination of the data suggested that Monday through Thursday have similar levels of domestic violence and, hence, can be grouped into one 'mid-week' category. Monthly effects were found to be insignificant (after controlling for Christmas holiday effects) and are not included.

¹¹We restrict our attention to league matches and do not include any Cup fixtures in our data.

¹²We used the website <http://www.football-data.co.uk> to collate this data.

	No. Obs.	Mean	Standard Deviation	Min	Max
All days	3200	64.46	22.0	12	225
Mid-week	1829	53.06	13.76	12	218
Friday	457	81.20	17.96	34	225
Saturday	457	93.49	19.00	46	178
Sunday	457	64.34	17.80	23	161
Xmas/NY	91	90.32	34.82	45	225
2003	365	48.70	16.63	12	138
2004	366	56.25	17.19	28	160
2005	365	57.58	18.04	19	151
2006	365	63.64	18.61	30	118
2007	365	64.10	19.83	31	151
2008	366	72.48	22.05	37	218
2009	365	71.35	23.00	30	173
2010	365	69.94	22.99	32	225
2011	278	79.81	22.82	40	161
Celtic plays	328	79.98	24.18	35	178
Rangers plays	329	81.61	24.92	35	178

Table 1: Summary statistics for the number of domestic violence incidents in Strathclyde as a whole. ‘Mid-week’ incorporates Monday through Thursday inclusive. The Christmas and New Year holiday (Xmas/NY) is defined as 24th December to 3rd January inclusive. Note that our sample finishes part way through 2011.

games in a league season. Teams receive 3 points for a win, 1 point for a draw and no points if they lose. The team that accumulates the most points after 38 matches wins the league. There is relegation from the SPL each season and this explains why there are 18 teams in the data set.

For each season all matches that took place in the season are listed along with several details of the match: the ‘home’ and ‘away’ teams, the half-time and full-time results and some information about the match (such as the number of fouls and the number of ‘bookings’). In our sample, Celtic played 328 games and Rangers 329.¹³ 35 of these are the Old Firm matches where Celtic and Rangers play each other. Of the Old Firm matches in the sample, Celtic won 17, Rangers won 13 and there was a draw on 5 occasions. Of the other matches played, Celtic won 222, drew 43 and lost 28; and Rangers won 213, drew 53 and lost 28.

The two teams under consideration are generally the dominant teams in the SPL; this is reflected both in the fact that either Celtic or Rangers won the league in all years in our sample, and in the betting odds. Information on pre-match betting odds offered by a number of bookmakers for a home win, a draw, and an away win is included in the football data. The betting odds are available for around 10 bookmakers for most of the sample which we convert into the average pre-match probability that Celtic and Rangers will win each match. Figures 2 and 3 plot the probability of winning for Celtic and Rangers

¹³Our sample period starts and stops during the season.

respectively for each match against each of the 17 teams that have played in the SPL over the sample period.¹⁴ The probability of each team winning the matches they are engaged in suggest that when Celtic and Rangers play each other (Celtic is team 2 and Rangers is team 16) the match is invariably predicted to be close, and when they play other teams there is a mixture of matches where the outcome is predicted to be close or the team is predicted to win.¹⁵

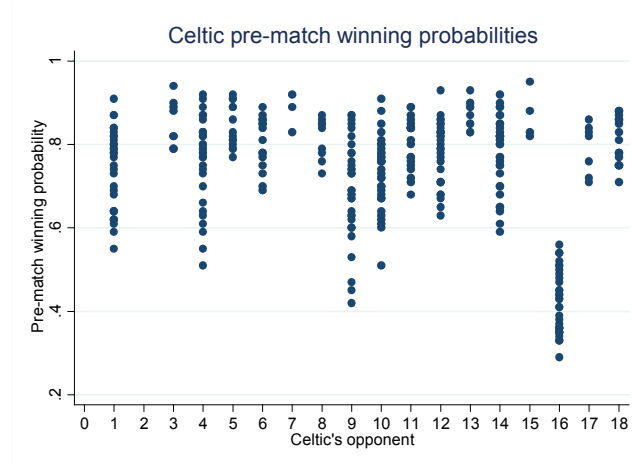


Figure 2: Pre-match average probability of Celtic winning.

3 Econometric Methods

Our aim is to explain variation in the level of domestic violence using information on whether a football match involving Celtic and/or Rangers takes place along with the features of that match. We have a panel data set where observations on our dependent variable (number of domestic violence incidents) differ across time and subdivision. However, our explanatory variables (e.g. results of football matches, day of week dummies, etc.) do not vary across subdivisions. This means that a regression using data for Strathclyde as a whole will be equivalent to a fixed effects panel data model (and virtually equivalent to random effects panel data models) using data at the subdivision level. Hence, results in this paper are from a Poisson regression model in which the dependent variable is the number of domestic violence incidents in Strathclyde as a whole and

¹⁴We coded the teams that play or have played in the SPL as 1=Aberdeen, 2=Celtic, 3=Dundee, 4=Dundee United, 5=Dunfermline, 6=Falkirk, 7=Gretna, 8=Hamilton, 9=Hearts, 10=Hibernian, 11=Inverness Caledonian Thistle, 12=Kilmarnock, 13=Livingstone, 14=Motherwell, 15=Partick, 16=Rangers, 17=St Johnstone, 18=St Mirren.

¹⁵There is a single outlier for Rangers (Figure 3) for a match against Hearts that occurred on 19th March 2006 where the winning probability for Rangers was only 15%.

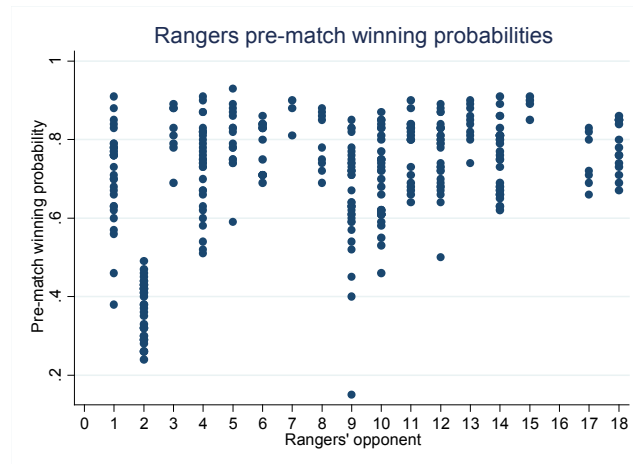


Figure 3: Pre-match average probability of Rangers winning.

explanatory variables are day-of-the-week, year and holiday dummies, as well as the variables related to the context and outcome of football matches that we will use to seek to explain variations in the level of domestic violence, described in the following section. An online appendix presents results for a range of alternative specifications.

The data incorporates acts of domestic violence committed by both Celtic and Rangers' fans. As such, a potential drawback of using regression techniques with the aggregated data is that the effects of various match outcomes might be imperfectly identified. For example, if Rangers unexpectedly lose it may be that for Rangers fans (for whom this is bad news) levels of domestic violence increase, whilst Celtic fans (for whom this is good news) commit fewer acts of domestic violence. If this is true, then the effect on domestic violence resulting from the unexpected loss for Rangers will be under-estimated.

We assume throughout that the effect of a positive or negative result for any other team than that which a fan supports is not large enough to prompt a change in that fan's propensity to engage in domestic violence (except, of course, when the two teams play each other). The important aspect of this in terms of identifying the effect of unexpected losses is that if Celtic or Rangers unexpectedly lose the propensity of fans of the other team (for whom this is good news) to commit acts of domestic violence is not reduced. This is supported by a finding of [Card and Dahl \(2011\)](#) that when a team wins (a positive outcome for that team's fans) there is no significant effect on levels of domestic violence whether the win was expected or unexpected, suggesting that good news does not influence fans' propensity to engage in domestic violence and, therefore, that good news received as a result of a bad outcome for a rival team will have

no effect as well.

If Glasgow was a segregated city and fans of different teams lived in distinct sub-divisions, we could effectively use a mixed effects panel data model to allow coefficient estimates to vary across sub-divisions. This would allow us to identify differential effects across the Strathclyde region resulting from the features of matches played by Celtic and Rangers, which would overcome the identification issue raised above, if it were a problem. However, whilst there are areas of Glasgow that are Celtic or Rangers strongholds, it is far from a segregated city. This, combined with the computational intensity of allowing any more than a few parameter estimates to vary across sub-divisions, leads us to base our main results on regressions using aggregated data. We do, however, use the results of a mixed effects model to provide some support for the assumption just made by looking at correlations between parameter estimates, the details of which are included in an online appendix.

4 Factors to Explain Levels of Domestic Violence

It is hypothesised that fans engaging with a football match involving their preferred team receive an emotional cue which influences their subsequent decision of whether to commit an act of domestic violence. The strength of the emotional cue triggered by a match taking place may depend on a number of factors related to its context and the outcome, which we now discuss.

4.1 Match Context

We classify each day in our sample as falling into one of the four categories: neither Celtic or Rangers play; only Celtic plays; only Rangers plays; both Celtic and Rangers play. We further delineate the latter category into those days where Celtic and Rangers both play but do not play each other (`candr`), and those days where there is an Old Firm match and they do (`oldfirm`). The explanatory variables listed in Table 2 are used in the analysis to distinguish between types of days. This allows the effect associated with the traditional Old Firm rivalry to be identified after controlling for any effect that arises from both teams being engaged in football matches on the same day, as well as identifying any change in domestic violence associated with either Celtic or Rangers playing when the other team does not.

We also introduce dummy variables to control for whether matches are played at home (although ‘away’ matches do not necessarily take place particularly far away from Glasgow) and whether they are televised. All Old Firm

Variable	No match	Only Celtic	Only Rangers	Celtic & Rangers	Old Firm
<code>conly</code>	0	1	0	0	0
<code>ronly</code>	0	0	1	0	0
<code>candr</code>	0	0	0	1	1
<code>candr\neg</code>	0	0	0	1	0
<code>oldfirm</code>	0	0	0	0	1

Table 2: Variables that identify different types of match day.

matches are played in Glasgow and are televised, so we only consider these variables for non-Old Firm matches, defining the dummy variables `c(r)home` and `c(r)tv` to control for these factors. Half of each team’s matches are at home, and roughly half are televised.

As identified by [Card and Dahl \(2011\)](#), three factors of a match might make it particularly ‘emotionally charged’, or salient, and therefore provide a stronger emotional cue for fans that may influence domestic violence: whether the match itself is important in terms of the team winning the tournament they are contesting; whether the match is against a ‘traditional rival’; and whether the actual play in the match is particularly heated. We introduce similar classes of variables to attempt to understand whether particularly emotionally charged matches are associated with a higher level of domestic violence in Strathclyde.

[Card and Dahl \(2011\)](#) used a measure of ‘playoff contention’ to distinguish between those games where a team no longer has a chance of qualifying for the play-offs, and those where there is at least a mathematical possibility of making the play-offs; for 68% of the games in their sample a team is in playoff contention. If applied to Celtic and Rangers in the SPL (the strongest teams in the league) this would include all but the very few matches at the end of some seasons where the winner of the league has already been decided. Instead, we consider two different definitions to identify salient matches. The first appeals to a distinct feature of the SPL: there is a natural break point in each season where the league is split and the teams in each half of the league play the remaining 5 matches against each other; if the team is in the top half of the league at this point (which is the case for both Celtic and Rangers for every season in our sample) and either has a lead of no more than 10 points, or is no more than 10 points away from the leader, we classify the game as ‘important’, which accounts for 8% of the matches in our sample.¹⁶ The variables `c(r)imp` take the value 1 if Celtic (Rangers) play a non-Old Firm match and it is ‘important’ (and are otherwise zero): `oldfirm_imp` takes the value 1 if an Old Firm match is important for either Celtic or Rangers (and is otherwise zero). The second definition, that we call ‘extended importance’, classifies a match as salient for

¹⁶These matches occur in 2003, 2005, 2008, 2009 and 2011 when the league was extremely competitive until the end of the season.

a team if it is one of the last 10 matches of the season and the team has a mathematical possibility of winning the league, which is true of 24% of the matches in our sample.

A match might also be salient when a team plays against a traditional rival. The Old Firm is perhaps the leading example in the world of such a traditional rivalry, which we naturally control for. In the SPL there are only a few other traditional rivalries that involve Celtic or Rangers that we might want to account for: when Celtic play Hearts and Rangers play Hibernian, and when either team plays Aberdeen, for which we define the variables `c(r)vstr` that take the value 1 if Celtic (Rangers) plays Hearts (Hibernian) or Aberdeen, and are otherwise zero (which accounts for roughly one fifth of each team’s non-Old Firm matches).

A slightly less well-defined but potentially important feature that might make a game salient is whether the play in the match was particularly controversial. To get a handle on this we introduce the variables `c(r)ref` that take the value 1 when Celtic (Rangers) play a non-Old Firm match and either the number of bookings (red and yellow cards) or the number of fouls is larger than the average of all such games, and are otherwise zero. `oldfirm_ref` is a similar measure for Old Firm matches.

4.2 Match Outcome

The outcome of a football match may also influence the emotional cue fans receive, and consequently their propensity to commit an act of domestic violence. A reasonable hypothesis is that if a fan’s team loses this results in a negative emotional cue, and the emotional cue is weakly increasing in the match outcome: draws and wins result in less negative, and perhaps positive, emotional cues. The idea of loss aversion—that losses relative to a reference point loom larger than equivalent-sized gains—could be considered in the setting of football by hypothesising the reference point to be the outcome of a draw, so losing is perceived as a loss and winning a gain. Loss aversion then implies that losing will result in a larger reduction in the emotional cue felt relative to that when the team draws than the increase in the emotional cue relative to a draw when the team wins. Hence, the basic hypothesis resulting from the idea of loss aversion is that if a team loses there will be a greater increase in domestic violence than any reduction in domestic violence when the team wins (relative to the level of domestic violence when the team draws).

The literature on loss aversion and prospect theory also considers that the reference point individuals use to classify outcomes as gains or losses might be influenced by their expectations, implying that the evaluation of an outcome depends on prior expectations. Figure 4 illustrates how the evaluation of the

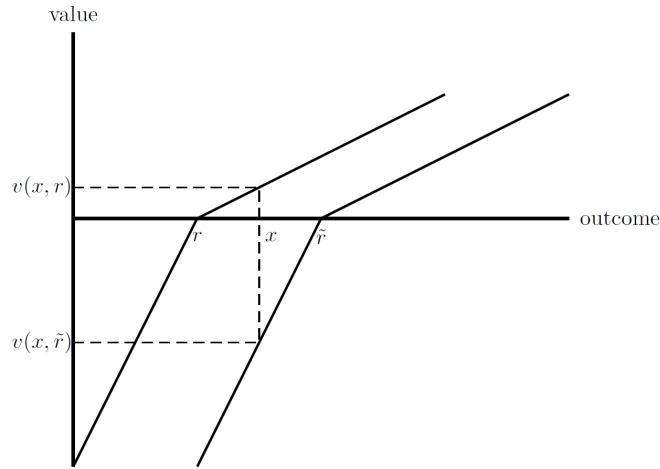


Figure 4: Prospect theory with endogenous reference points.

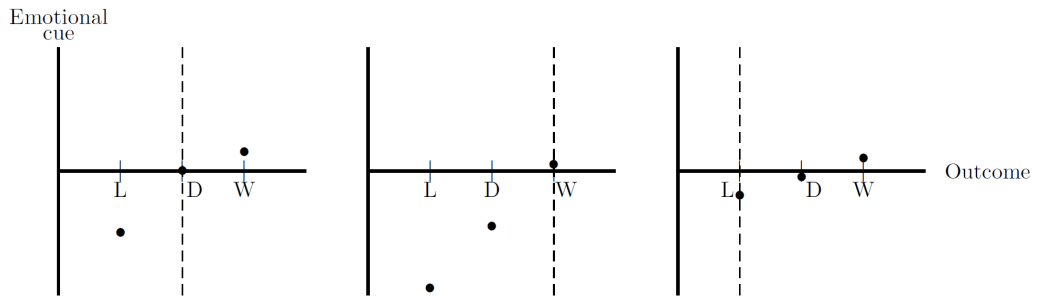


Figure 5: Expectations, outcomes and emotional cues in football.

outcome x is different depending on an individual's expectations which constitute the reference point: if this is r the outcome x is seen as a gain, whilst if it is \tilde{r} x is seen as a loss. This idea dates back to the early literature on disappointment theory by [Bell \(1985\)](#) and [Loomes and Sugden \(1986\)](#) who considered that when evaluating lotteries individuals form an expectation about what they will receive from the lottery and if the outcome is worse (better) than expected they will suffer (enjoy) disappointment (elation). [Shalev \(2000\)](#) incorporates loss aversion with endogenously-determined (consistent) reference points into strategic situations, and [Gill and Stone \(2010\)](#) apply the idea to rank-order tournaments where the reference point is determined by a comparison of effort between players. [Kőszegi and Rabin \(2006\)](#) model endogenously determined reference points formed consistently from rational expectations.

A reasonable measure of fans' expectations in football is pre-match betting odds. Figure 5 illustrates the implications of expectations-based reference-dependent preferences applied to football. Panel a) considers the case where the match is expected to be tight, so the expected outcome is a draw (or, indeed, where the reference point is exogenously set as a draw). Then losing is coded as a loss and winning as a gain, each of which is 'mildly unexpected'. Normalizing the emotional cue from observing a draw to zero ($D|D = 0$), loss aversion implies the emotional cue from losing ($L|D$) is relatively large and negative, whilst the emotional cue from winning ($W|D$) is small and positive. Panel b) considers the case where the team is expected to win. If the team does win then expectations are met; if the outcome is a draw fans will suffer mild disappointment; and if the team loses they will be more disappointed. As such, the emotional cue from drawing is relatively large and negative ($D|W$) and from losing is even larger and negative ($L|W$). For completeness, panel c) presents the case where the team is expected to lose, but as noted the pre-match betting odds suggest that neither Celtic or Rangers are ever expected to lose in the SPL.

The hypothesis of loss aversion coupled with expectations-determined reference points consequently gives rise to the following hypotheses for the current study: 1) if loss aversion is present then in those games where the outcome was expected to be a draw and a team actually loses there will be a greater increase in domestic violence than the reduction in domestic violence if the team wins, relative to the level of domestic violence when the team draws: $-L|D > W|D$; 2) if expectations play a role in determining fans' perceptions of the outcome of a match, then a) the effect on domestic violence when a team loses will be higher when the team was expected to win (involving disappointment) than when the outcome was expected to be a draw (involving only mild disappointment): $L|W < L|D$; b) the effect on domestic violence when a team draws will be larger if the team was expected to win (involving mild disappointment) than if the outcome was expected to be a draw: $D|W < D|D$; and c) when a team wins the reduction in domestic violence will be larger if the team was expected to draw (involving mild elation) than if the team was expected to win: $W|D > W|W$.

To determine whether simple match outcomes matter in explaining the level of domestic violence we define the variables `c(r)win/draw/lose` that take the value 1 if Celtic (Rangers) play a non-Old Firm match and win/draw/lose. In addition, we define the variables `oldfirm_draw/close/rlose` to identify Old Firm matches that result in a draw/Celtic losing/Rangers losing.

To clearly define what is unexpected we take pre-game betting odds as a proxy for expectations (following Card and Dahl (2011)) and postulate (somewhat arbitrarily but we believe sensibly given the observed pre-match betting

odds) that if the pre-match winning probability is at least as large as 70% ($q \geq 0.7$) then the team is expected to win, and if $q < 0.7$ the game is expected to be ‘tight’ (so a draw is the expected outcome). This definition is consistent with reality in the SPL which is that neither Celtic or Rangers are ever expected to lose; and all Old Firm games are expected to be tight.¹⁷ As such, there will never be ‘unexpected wins’ (where a team is expected to lose but wins) or predicted losses in our data; and in Old Firm games the result will never be more than ‘mildly unexpected’. For non-Old Firm matches we classify the outcome of the match in relation to the pre-match winning probability (q) as one of the categories detailed in Table 3, for which we define indicator variables for both Celtic and Rangers.

Prob. win	Lose	Draw	Win
$q \geq 0.7$	favlose (disappointed)	favdraw (mildly disappointed)	favwin (expectations met)
$q < 0.7$	tightlose (mildly disappointed)	tightdraw (expectations met)	tightwin (mildly elated)

Table 3: Match outcomes relative to pre-game expectations.

5 Results and Discussion

In this section we report the results of our attempts to try to explain the level of domestic violence in Strathclyde as a whole using various features of football matches discussed in Section 4. Our empirical results are presented in Tables 4 and 5. Table 4 presents the first set of empirical results investigating whether the presence, context and outcome of football matches involving Celtic and Rangers can explain levels of domestic violence; Table 5 investigates whether levels of domestic violence can be explained by match outcomes conditional on expectations.

All explanatory variables are dummy variables so the coefficients should be interpreted as the change in the log of the average number of domestic violence incidents as a result of the indicator variable taking the value 1, or (approximately) the percentage change in the average level of domestic violence on days that have the characteristics of the indicator variable compared to days that do not.

In all of the regressions reported we control for year (2003 is the omitted dummy variable), day of the week (Saturday is the omitted variable) and the

¹⁷As a robustness check, we repeated our analysis with thresholds of 0.6 and 0.8. Results are discussed in the online appendix.

Christmas and New Year holiday period. Of note is the observation that the coefficient for `xmas_ny`, which identifies days between 24th December to 3rd January inclusive, is consistently around 0.33, signifying a 33% increase in domestic violence during the holiday season.

In model (A1) we regress the total number of domestic violence incidents in Strathclyde on the basic match indicator variables, and find a strong significant effect when both Celtic and Rangers play, but model (A2) finds the majority of this effect is attributable to Old Firm matches: domestic violence increases by 36% when there is an Old Firm match, a similar increase to the Christmas holiday effect alluded to above. Other traditional rivalries, however, make very little difference. Model (A3) includes our context variables (identifying games that are played at home and those that are televised); model (A4) includes the effect of games that are ‘important’ (the match is one of the last five of the season after the split in the league, and the league is still being contended); and model (A5) includes the effect of matches involving a greater than average number of fouls or bookings.

In terms of explaining domestic violence using match indicator and context variables model (A4) is our preferred specification¹⁸, which demonstrates that there is a large and significant Old Firm effect but when Rangers and Celtic are engaged in matches against other teams in the SPL there is in general no significant effect on the level of domestic violence, even when the match is against a non-Old Firm traditional rival. There is a positive and significant *additional* effect when Celtic and Rangers are engaged in matches against other teams that are important (9.1% and 8.5%, respectively) relative to non-important matches. However, the *overall* effect of important matches for Celtic and Rangers (which combines the coefficients on appropriate explanatory variables) is often insignificant. For instance: the effect when only Celtic plays and the match is important (p-value=0.551); when only Rangers plays and the match is important (p-value=0.458); and when both teams play but not each other and both matches are important (p-value=0.102), are insignificant even at the 10% level. However, non-Old Firm matches that are both important and televised give rise to a significant additional effect for both Celtic and Rangers (p-values of 0.001 for Celtic and 0.013 for Rangers), the overall effect of which is statistically significant (p-values of 0.026 when only Celtic play and 0.085 when only Rangers play).

This suggests that it is not football in general that is associated with domes-

¹⁸This model suggests that match importance is a key explanatory factor, including which reduces the influence of Celtic and Rangers playing on the same day in a non-Old Firm match, and matches being televised. Whilst model (A5) also controls for matches involving a greater than average number of fouls or bookings, these coefficients are insignificant.

	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)
conly	-0.00659 (0.0125)	-0.00409 (0.0134)	-0.0717* (0.0408)	-0.0547 (0.0369)	-0.0657* (0.0378)	
ronly	-0.00578 (0.0132)	-0.00452 (0.0146)	-0.0467 (0.0302)	-0.0411 (0.0295)	-0.0355 (0.0305)	
candr	0.134*** (0.0208)					
candr \neg		0.0539*** (0.0197)	-0.0578 (0.0473)	-0.0255 (0.0465)	-0.0262 (0.0502)	
oldfirm		0.357*** (0.0343)	0.359*** (0.0348)	0.343*** (0.0388)	0.387*** (0.0710)	
cvstr		-0.00213 (0.0223)	-0.000442 (0.0217)	-0.00549 (0.0210)	-0.00845 (0.0213)	-0.00631 (0.0216)
rvstr		-0.00273 (0.0223)	-0.00414 (0.0216)	-0.00568 (0.0206)	-0.00471 (0.0209)	-0.00728 (0.0210)
chome			0.0447 (0.0359)	0.0253 (0.0334)	0.0277 (0.0336)	0.0208 (0.0339)
rhome			0.0278 (0.0298)	0.0195 (0.0295)	0.0188 (0.0296)	0.0184 (0.0291)
ctv			0.0850** (0.0361)	0.0567* (0.0339)	0.0560 (0.0344)	0.0591* (0.0344)
rtv			0.0578** (0.0291)	0.0384 (0.0293)	0.0384 (0.0294)	0.0464 (0.0289)
cimp				0.0906** (0.0418)	0.0894** (0.0425)	0.0823* (0.0444)
rimp				0.0846* (0.0483)	0.0841* (0.0486)	0.0771 (0.0504)
oldfirm_imp				0.101 (0.0655)	0.126* (0.0685)	0.106 (0.0685)
cref					0.0174 (0.0195)	
rref					-0.0133 (0.0211)	
oldfirm_ref					-0.0687 (0.0822)	
oldfirm_draw						0.388*** (0.112)
oldfirm_close						0.410*** (0.0537)
oldfirm_rlose						0.285*** (0.0464)
cwin						-0.0254 (0.0376)
cdraw						-0.0469 (0.0399)
close						-0.0323 (0.0514)
rwin						-0.0256 (0.0280)
rdraw						0.000181 (0.0366)
rlose						-0.0253 (0.0381)
intercept	4.223*** (0.0144)	4.229*** (0.0141)	4.233*** (0.0142)	4.232*** (0.0142)	4.233*** (0.0142)	4.230*** (0.0143)
N	3200	3200	3200	3200	3200	3200

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: The effect on domestic violence in Strathclyde resulting from football matches involving Celtic and Rangers.

tic violence, but Old Firm matches in particular, with the possible exception of non-Old Firm matches that are both important and televised.

Model (A6) controls for the outcome of matches, which demonstrates that there is little change in domestic violence depending on match outcomes. If the reference point is exogenously taken as a draw so that losses are coded as a loss and wins as a gain, these results suggest there is no differential effect of a loss compared to a gain and therefore that loss aversion is not at work here. Note that there is heterogeneity in the effect of Old Firm matches depending on the outcome: it is highest at 41% when Celtic lose, which is similar to the effect of a draw, and lowest at 29% when Rangers lose. However, the p-value for a test of equality is 0.065, so a null hypothesis of the effect being the same cannot be rejected at the 5% level of significance.

We now turn to the question of whether expectations-based reference points are important in explaining domestic violence. The results in Table 5 investigate whether match outcomes relative to pre-match expectations (proxied by pre-match betting odds) have any power in explaining the level of domestic violence. Despite model (A6) suggesting there is no discernible effect on domestic violence of different outcomes of non-Old Firm matches, it may be the case that for those matches that resulted in a loss and that loss was unexpected (an ‘upset’ loss) there is a significant effect on domestic violence, as found by [Card and Dahl \(2011\)](#). By classifying match outcomes relative to pre-match betting odds as described in Table 3 we can test whether this is the case in Strathclyde.

Model (B1) is the same as model (A6) of Table 4 except that explanatory variables which categorise match outcomes according to pre-game betting odds are included. The results of this model demonstrate a feature that stands in contrast to the findings of [Card and Dahl \(2011, Table IV, p 25\)](#). They find that, whilst outcomes that accord with expectations have no effect on domestic violence (whether they are wins or losses), there is a statistically significant 10% increase in the level of domestic violence in the team’s home city when that team plays a game that it loses when it was expected to win. Furthermore, they also find this effect to be significantly different both from the effect of an expected loss, and of an upset win. This allowed them to conclude that fans exhibit reference dependent behaviour. We are not finding this. If fans in Glasgow exhibited loss aversion around expectations-based reference points then unexpectedly bad outcomes—identified by the variables `c(r)favlose`, `c(r)favdraw` and `c(r)tightlose`—would have significant positive coefficients, but this is not so in our data. Whether loss aversion is at work around the reference outcome of a draw can be considered by comparing the coefficients on `c(r)tightlose` and `c(r)tightwin`, but each of these is insignificant. Whether expectations play

	(B1) All matches	(B2) Importance	(B3) Extended importance	(B4) Traditional rival	(B5) Referee active
cfavwin	-0.0306 (0.0389)	-0.0197 (0.0375)	-0.0440 (0.0380)	-0.0166 (0.0380)	-0.0426 (0.0414)
ctightwin	-0.0240 (0.0422)	-0.00753 (0.0412)	-0.0414 (0.0409)	-0.0295 (0.0437)	-0.0491 (0.0708)
cfavdraw	-0.0570 (0.0463)	-0.0652 (0.0467)	-0.0864* (0.0477)	-0.0869* (0.0470)	-0.0788 (0.0603)
ctightdraw	-0.0406 (0.0451)	-0.0296 (0.0463)	-0.0479 (0.0539)	-0.0637 (0.0515)	-0.0696 (0.0938)
cfavlose	-0.0124 (0.0604)	-0.0415 (0.0590)	-0.0643 (0.0783)	-0.0169 (0.0691)	0.00471 (0.0985)
ctightlose	-0.0689 (0.0651)	-0.0575 (0.0639)	-0.0823 (0.0634)	0.00139 (0.0552)	-0.00111 (0.0726)
rfavwin	-0.0321 (0.0318)	-0.0377 (0.0315)	-0.0374 (0.0326)	-0.0352 (0.0317)	-0.0118 (0.0361)
rtightwin	-0.0215 (0.0316)	-0.0336 (0.0310)	-0.0492 (0.0343)	-0.0154 (0.0320)	-0.0250 (0.0356)
rfavdraw	-0.0133 (0.0463)	-0.0239 (0.0469)	-0.0273 (0.0520)	-0.00687 (0.0500)	-0.0224 (0.0626)
rtightdraw	0.0133 (0.0445)	0.0262 (0.0455)	0.0448 (0.0463)	-0.0145 (0.0509)	0.0255 (0.0645)
rfavlose	-0.0241 (0.0469)	-0.0315 (0.0466)	-0.0237 (0.0513)	-0.0402 (0.0512)	-0.0904** (0.0457)
rtightlose	-0.0252 (0.0487)	-0.0379 (0.0502)	-0.0415 (0.0510)	-0.0476 (0.0764)	-0.194 (0.142)
cfavwin_sal		0.0123 (0.0799)	-0.0190 (0.0479)	-0.0728* (0.0409)	-0.0261 (0.0418)
ctightwin_sal		-0.0165 (0.101)	-0.00162 (0.0648)	-0.00289 (0.0461)	-0.0270 (0.0447)
cfavdraw_sal		0.372*** (0.141)	0.0677 (0.143)	0.147** (0.0709)	-0.0445 (0.0524)
ctightdraw_sal		0.0184 (0.0349)	-0.0685 (0.0446)	-0.0146 (0.0464)	-0.0410 (0.0460)
cfavlose_sal		0.208 (0.128)	0.0357 (0.0832)	0.0215 (0.0891)	-0.0416 (0.0493)
ctightlose_sal		omitted	omitted	-0.132 (.)	-0.107 (0.0867)
rfavwin_sal		0.0189 (0.0736)	-0.0219 (0.0477)	-0.0346 (0.0458)	-0.0423 (0.0330)
rtightwin_sal		0.0400 (0.126)	0.0303 (0.0409)	-0.0759 (0.0466)	-0.00354 (0.0389)
rfavdraw_sal		0.240*** (0.0308)	0.0218 (0.0572)	-0.0423 (0.0625)	0.00168 (0.0507)
rtightdraw_sal		-0.0858** (0.0389)	-0.108 (0.0679)	0.0213 (0.0637)	0.0139 (0.0539)
rfavlose_sal		omitted	-0.133* (.)	0.0372 (0.0895)	0.0484 (0.0661)
rtightlose_sal		0.159** (0.0726)	0.160*** (0.0513)	-0.0250 (0.0381)	0.0158 (0.0434)
oldfirm_draw	0.388*** (0.112)	0.388*** (0.112)	0.388*** (0.112)	0.386*** (0.112)	0.388*** (0.112)
oldfirm_close	0.410*** (0.0536)	0.410*** (0.0537)	0.410*** (0.0536)	0.409*** (0.0535)	0.410*** (0.0537)
oldfirm_rlose	0.285*** (0.0464)	0.284*** (0.0464)	0.285*** (0.0464)	0.285*** (0.0463)	0.285*** (0.0465)
cvstr	-0.00549 (0.0222)	-0.00887 (0.0215)	-0.00751 (0.0216)		0.00278 (0.0235)
rvstr	-0.00812 (0.0218)	-0.00951 (0.0207)	-0.0125 (0.0221)		-0.0164 (0.0218)
chome	0.0251 (0.0352)	0.0187 (0.0351)	0.0359 (0.0352)	0.0199 (0.0349)	0.0283 (0.0362)
rhome	0.0252 (0.0331)	0.0312 (0.0328)	0.0330 (0.0337)	0.0252 (0.0332)	0.0210 (0.0333)
ctv	0.0634* (0.0349)	0.0557 (0.0341)	0.0775** (0.0337)	0.0573* (0.0342)	0.0671* (0.0367)
rtv	0.0457 (0.0286)	0.0507* (0.0285)	0.0619** (0.0285)	0.0502* (0.0291)	0.0402 (0.0286)
cimp	0.0775* (0.0441)			0.0736* (0.0421)	0.0757 (0.0464)
rimp	0.0771 (0.0507)			0.0651 (0.0486)	0.0770 (0.0511)
oldfirm_imp	0.105 (0.0685)	0.106 (0.0686)	0.105 (0.0685)	0.105 (0.0685)	0.106 (0.0687)
intercept	4.230*** (0.0143)	4.231*** (0.0143)	4.230*** (0.0144)	4.230*** (0.0143)	4.230*** (0.0143)
N	3200	3200	3200	3200	3200

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: The effects of match outcomes relative to expectations on domestic violence in Strathclyde.

a role in determining how fans evaluate match outcomes, as discussed in Section 4, can be ascertained by comparing the coefficients on $c(r)favlose$ with $c(r)tightlose$, and $c(r)favdraw$ with $c(r)tightdraw$, but again all these coefficients are insignificant. As such, we conclude that match outcomes that are disappointing relative to expectations do not seem to trigger domestic violence.

The preceding result was based on all matches. It is possible that unexpectedly bad results only have an impact in salient games. This issue is investigated in Card and Dahl (2011, Table VI, p 30). They considered whether the upset loss effect persisted in both salient and non-salient games, where salience was defined in three ways: games where the team was still in playoff contention; games against traditional rivals; and games that are particularly frustrating for fans. Their findings are that “the overall rise in...[domestic violence incidents]...following an upset loss is driven entirely by losses in games that “matter” the most to fans”: coefficient estimates of the increase in domestic violence for upset losses in games that possess one of the salience characteristics are at least twice as large as in games that do not possess that characteristic. For our data this hypothesis is investigated in models (B2) to (B5). In these models matches are split into two types – those that possess the salience characteristic listed at the top of each column and those that do not – and are further characterised by the match outcome relative to pre-match expectations as in model (B1). The coefficient estimates reported in the first block of the table are for those matches that *do not* have the salience characteristic of the column, and the second block of estimates is for those matches that do (post-scripted with `_sal`), where the coefficient estimates give the *total* effect on domestic violence from a match that possesses that characteristic.

Model (B2) distinguishes between those matches that are classed as non-important in the upper block and those matches that are important in the second block. As discussed in Section 4 our measure of match importance is purposefully restrictive to focus attention on those matches at the end of the season where the title is still to play for, that are particularly salient for fans. The consequence is that there are few observations, and indeed two parameter estimates are omitted as there are no observations that fall into those categories. We found in model (A4) that matches that are important do have a significant effect on levels of domestic violence. The results from model (B2) suggest that, whilst there is no effect on domestic violence from non-important matches regardless of the outcome, in important games there is indeed a significant effect from unexpectedly bad results: when Celtic are predicted to win and draw domestic violence increases by 37% (p-value 0.008) compared to a reduction of 6.5% in non-important games (p-value for a test of equality between the coefficients is 0.001); when they are predicted to win but lose domestic

violence increases by 21% (although this is not statistically significant due to the large standard error resulting from very few observations of this type – p-value=0.104). Similarly, when Rangers are predicted to win and draw domestic violence increases by some 24% which is strongly significant (p-value ≈ 0), which can be compared to an effect of -2% in non-important games (p-value for test of equality ≈ 0). In addition, when Rangers play an important game that is predicted to be tight and they lose there is a significant 16% increase in domestic violence (p-value=0.028), which is significantly different from the effect in non-important games (p-value for test of equality is 0.008).

Data limitations mean that we cannot test whether the effect of a loss when the team was predicted to win in important games differs from that of a loss when the game was expected to be tight, so we cannot conclude that it is not just the act of losing per se that gives rise to the increase in domestic violence. However, if we focus on draws we can deduce richer conclusions. For both Celtic and Rangers the effect of a draw when the team was expected to win is positive and significant (as previously discussed, 37% (p-value 0.008) for Celtic and 24% (p-value ≈ 0) for Rangers), and is significantly different from the effect of a draw when a game is expected to be tight which is insignificant for both teams (p-value for a test of equality between the coefficients on `favdraw` and `tightdraw` is 0.006 for Celtic and ≈ 0 for Rangers). This suggests that in important games the effect of a draw is different when it is unexpected compared to when the match was predicted to be tight. By contrast, in important games that the teams win, there is no significant effect on domestic violence whether the win was expected or not. In conclusion, in those games that are classed as important, there seems to be a significant effect on the level of domestic violence when the teams lose. Moreover, there is a significant effect on domestic violence when a team draws, but only when they were expected to win; games that result in a draw but were expected to be tight have no significant effect on domestic violence levels. As such, in important matches we identify an ‘upset non-win’ effect: disappointment relative to expectations that comes from unexpectedly bad outcomes, even if it is mild, is associated with higher levels of domestic violence.

In model (B3) we expand the definition of importance to incorporate the last 10 matches of the season where the team has a mathematical possibility of winning the league. This expands the number of matches that are classed as important, but very interestingly changes the conclusion that there is an effect from unexpectedly bad outcomes: all coefficients, except in Rangers matches that are predicted to be tight but they go on to lose, are insignificant. The significant 16% effect of Rangers losing games which were expected to be tight is in fact based on a single match on Thursday 22nd May 2008 when Rangers

lost a match that cost them the league soon after losing the UEFA Cup final on 14th May. Excepting this single match, extending the definition of importance means we cannot conclude an ‘upset non-win’ effect: there is some evidence that unfulfilled expectations of a win have a significant effect on the level of domestic violence in Strathclyde, but this is true only in those particularly salient matches right at the end of the season where the title is still to play for.

In models (B4) and (B5) we test whether there is an effect of disappointing outcomes in matches against non-Old Firm traditional rivals and where the number of fouls or bookings is above average, but find no evidence of this in these matches.

The overall picture from our empirical results is that the dominant effect on domestic violence is associated with Old Firm matches: when an Old Firm match takes place the average level of domestic violence increases by some 28-41% depending on the outcome. In general, football matches that do not involve an Old Firm clash have no significant relationship with the average level of domestic violence. Only in games that are particularly salient is there a significant effect associated with upset non-wins, but importance has to be defined very tightly in order to get this result.

6 Conclusion

When investigating the effect of American football on levels of domestic violence in the US, [Card and Dahl \(2011\)](#) found that there is a significant positive effect on domestic violence in a team’s home city when that team suffers an upset loss. We investigate whether the same is true in Glasgow and surrounding areas focussing on games that involve Celtic and Rangers. We find that there is a very large and significant effect on domestic violence associated with Old Firm matches of the same order of magnitude as the increase in domestic violence around Christmas and the New Year. We test for the effect of fans’ expectations not being met in the form of ‘upset non-wins’ but find very little evidence to support the conclusion: we only find this evidence in a very limited set of matches where the battle to win the league is particularly intense and this strikes us as very surprising.

Our conclusion, therefore, is that the manifestation of loss aversion and the influence of losses in sport relative to expectations on the incidence of domestic violence very much depends on the context of the league. In the SPL where there is a strong traditional rivalry in the form of the Old Firm match outcomes that do not meet fans’ expectations play very little role in explaining levels of domestic violence, which increase significantly on days when an Old Firm match

is played. The hypothesis of [Card and Dahl \(2011\)](#) implies that there is a kink in the payoff function of fans at the expected outcome. Our hypothesis is that the angle of this kink is reduced by other salient features of the league. If there are other more dominant factors that fans care about then other matches do not feature so much in their emotions. We look forward after the passage of time to investigating this claim using the natural experiment of Rangers' exit from the SPL to understand the pattern of domestic violence in the absence of regular Old Firm clashes.

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