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

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A Alternative Specifications

In this section we present the results of alternative specifications to check the robustness of our results presented in Tables 4 and 5. Towards the end of this section we present the results of our models estimated using negative binomial regression and OLS methods. With the latter, the log of the number of domestic violence incidents is the dependent variable. These give almost identical results to those estimated using Poisson regression methods presented in the paper. We also consider the effect of changing the probability of winning threshold that governs our classification of expectations. In the following section we present results using a mixed effects model.

A.1 Altering the winning probability threshold

In this subsection we consider the effect on our results of changing the probability that defines whether a match is predicted to be close or whether the team is expected to win. The aim of setting this threshold is to separate the matches a team plays to clearly identify those where it is expected to win, allowing us to clearly classify unexpected outcomes. In the paper this threshold is 0.7. We believe this reflects the reality of non-Old Firm matches in the SPL (the average winning probability for Celtic is 0.77 and for Rangers is 0.75), and allows us to deduce that if a team is expected to win and then either draws or loses fans are likely to perceive this as disappointing relative to their expectations. That said, the selection of 0.7 is rather arbitrary so in this section we consider thresholds of 0.6 and 0.8.

When the threshold reduces to 0.6, the results from which are presented in Table A.1 (note that only the results in Table 5 change as the threshold does not affect the explanatory variables in Table 4), fewer matches are classified as tight. The estimates of model (B1') change very little except for the coefficient on `rtightdraw` increasing in magnitude due to the reduced number of observations falling into that category. Our original results suggest that in important matches where Celtic or Rangers are favourite to win a non-Old Firm match and the outcome is a draw there is an increase in domestic violence that is significantly different from a draw when a match is predicted to be tight. When the threshold is reduced to 0.6 the coefficients on `favdraw` become insignificant for both teams, and there are no observations where the match is predicted to be tight and the outcome is a draw. As such, we lose the basis of the 'upset non-win' effect we identified previously. The reason for this is that with the lower threshold all matches where the teams draw, even those where the winning probability is relatively low and so a draw might not be that unexpected, are grouped into a single category so the coefficient estimate is the average effect associated with

	(B1') All matches	(B2') Importance	(B3') Extended importance	(B4') Traditional rival	(B5') Referee active
cfavwin	-0.0252	-0.0266	-0.0426	-0.0153	-0.0411
	(0.0378)	(0.0359)	(0.0385)	(0.0367)	(0.0399)
ctightwin	-0.0289	-0.0371	-0.0821	0.00234	omitted
	(0.0611)	(0.0602)	(0.0733)	(0.0626)	(.)
cfavdraw	-0.0508	-0.0681*	-0.0812*	-0.0762*	-0.0774
	(0.0395)	(0.0405)	(0.0440)	(0.0414)	(0.0526)
ctightdraw	-0.0312	-0.0420	omitted	omitted	omitted
	(0.0480)	(0.0456)	(.)	(.)	(.)
cfavlose	-0.0289	-0.0614	-0.0791	-0.00179	0.00914
	(0.0556)	(0.0542)	(0.0660)	(0.0595)	(0.0834)
ctightlose	-0.0546	-0.0609	-0.0758*	-0.0470	-0.101*
	(0.0449)	(0.0432)	(0.0451)	(0.0439)	(0.0588)
rfavwin	-0.0305	-0.0355	-0.0417	-0.0365	-0.0115
	(0.0291)	(0.0288)	(0.0298)	(0.0286)	(0.0314)
rtightwin	0.00131	-0.00194	-0.00708	0.0288	-0.0638
	(0.0480)	(0.0478)	(0.0512)	(0.0498)	(0.0613)
rfavdraw	-0.0166	-0.0167	-0.0155	-0.0141	-0.0140
	(0.0387)	(0.0396)	(0.0421)	(0.0418)	(0.0494)
rtightdraw	0.141*	0.141*	0.196**	0.0519	0.239***
	(0.0770)	(0.0769)	(0.0782)	(0.0803)	(0.0428)
rfavlose	-0.0458	-0.0532	-0.0529	-0.0781	-0.136**
	(0.0418)	(0.0429)	(0.0464)	(0.0516)	(0.0625)
rtightlose	0.0371	0.0316	0.0274	0.0551	-0.0322
	(0.0460)	(0.0463)	(0.0463)	(0.0495)	(0.0389)
cfavwin_sal		-0.00911	-0.00943	-0.0454	-0.0210
		(0.0702)	(0.0477)	(0.0387)	(0.0397)
ctightwin_sal		omitted	0.0117	-0.0507	-0.0313
		(.)	(0.0664)	(0.0800)	(0.0620)
cfavdraw_sal		0.206	0.0195	0.0543	-0.0483
		(0.132)	(0.0781)	(0.0521)	(0.0429)
ctightdraw_sal		omitted	-0.0902*	-0.0309	-0.0258
		(.)	(0.0537)	(0.0390)	(0.0510)
cfavlose_sal		0.198	0.0358	-0.0764	-0.0696
		(0.126)	(0.0837)	(0.0797)	(0.0576)
ctightlose_sal		omitted	omitted	-0.0413	-0.0557
		(.)	(.)	(0.0527)	(0.0492)
rfavwin_sal		0.0384	-0.00494	-0.0465	-0.0367
		(0.0664)	(0.0389)	(0.0393)	(0.0310)
rtightwin_sal		omitted	-0.0116	-0.113*	0.0633
		(.)	(0.0355)	(0.0636)	(0.0580)
rfavdraw_sal		0.00170	-0.0621	-0.0485	-0.00611
		(0.0867)	(0.0559)	(0.0426)	(0.0430)
rtightdraw_sal		omitted	-0.0229	0.153	0.120
		(.)	(0.120)	(0.110)	(0.0994)
rfavlose_sal		0.181***	-0.0125	-0.00420	0.0166
		(0.0639)	(0.0929)	(0.0451)	(0.0464)
rtightlose_sal		omitted	omitted	-0.0202	0.0805
		(.)	(.)	(0.0555)	(0.0532)
oldfirm_draw	0.387***	0.387***	0.388***	0.386***	0.386***
	(0.112)	(0.112)	(0.112)	(0.112)	(0.112)
oldfirm_close	0.410***	0.409***	0.410***	0.409***	0.410***
	(0.0536)	(0.0536)	(0.0537)	(0.0535)	(0.0536)
oldfirm_rlose	0.285***	0.284***	0.285***	0.284***	0.284***
	(0.0464)	(0.0464)	(0.0465)	(0.0464)	(0.0465)
cvstr	-0.00925	-0.00333	-0.00378		-0.00842
	(0.0217)	(0.0209)	(0.0213)		(0.0225)
rvstr	-0.0139	-0.0172	-0.0177		-0.0197
	(0.0204)	(0.0197)	(0.0209)		(0.0204)
chome	0.0193	0.0238	0.0298	0.0155	0.0242
	(0.0344)	(0.0331)	(0.0356)	(0.0335)	(0.0346)
rhome	0.0262	0.0316	0.0347	0.0289	0.0209
	(0.0303)	(0.0301)	(0.0304)	(0.0300)	(0.0300)
ctv	0.0603*	0.0652*	0.0795**	0.0532	0.0647*
	(0.0346)	(0.0335)	(0.0354)	(0.0340)	(0.0357)
rtv	0.0453	0.0485*	0.0611**	0.0532*	0.0373
	(0.0294)	(0.0294)	(0.0292)	(0.0293)	(0.0294)
cimp	0.0837*			0.0800*	0.0807*
	(0.0446)			(0.0435)	(0.0454)
rimp	0.0825			0.0711	0.0817
	(0.0507)			(0.0488)	(0.0508)
oldfirm_imp	0.106	0.106	0.106	0.106	0.106
	(0.0685)	(0.0685)	(0.0686)	(0.0686)	(0.0686)
intercept	4.230***	4.231***	4.230***	4.229***	4.230***
	(0.0143)	(0.0143)	(0.0144)	(0.0143)	(0.0143)
N	3200	3200	3200	3200	3200

Robust standard errors in parentheses

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

Table A.1: The effects of match outcomes relative to expectations when the winning probability threshold is reduced to 0.6.

a draw. This makes sense, as fans in these lower probability matches are less disappointed with a draw than if the winning probability is higher. The only other change is that the coefficient on `rfavlose` becomes positive and significant which results from matches where Rangers lost that were classed as being tight are now classed as Rangers being favourite to win.

As such, lowering the threshold probability means unexpected results cannot be so easily identified by our categorical variables (e.g. `favdraw`) which means we no longer find an upset non-win effect in important matches.

When the threshold is increased to 0.8, the results of which are in Table A.2, a team is deemed to be favourite only when the pre-match betting probability is particularly high, so for such matches the team losing or drawing is on average more unexpected for fans than when the threshold is 0.7. Considering all matches in model (B1"), this change results in a significantly positive coefficient for Celtic when they are predicted to win and then lose; just as when we focussed on important matches we uncovered an upset non-win effect, when we focus on matches where the pre-match winning probability is particularly high—so losing such a match is particularly unexpected—we find such an effect. It seems as though there are some observations for Celtic where the winning probability is particularly high, the team loses and there is a high level of domestic violence. Model (B2") suggests that the majority of this effect is attributable to important matches (p-value for a test of equality between the coefficients on `cfavlose` in important matches and non-important matches is 0.097).

The conclusion that unexpectedly bad results in important games are associated with higher levels of domestic violence under this specification remains true for Celtic but the higher threshold probability means that for Rangers there are no observations where the team was favourite and the result was a draw so no conclusion can be made.

Our original model reported negative coefficients for many match category variables, suggesting a reduction in domestic violence associated with football. Some coefficient estimates with this specification suggest that this is significant, even when the team loses. This is a rather strange finding but further suggests that reference dependent behaviour coupled with loss aversion is not an appropriate description of fans' behaviour in general.

To summarise, the findings of our study suggest that unexpectedly bad results are not associated with increased levels of domestic violence in general. If we focus on particularly salient matches at the end of the season where the title is still being contested we do find an effect, but this is based on very few observations. If we relax the definition of 'expected to win' this result is lost. If we strengthen it so that a team is deemed favourite only when the winning probability is particularly high and so losing such a match would be particularly

unexpected there is evidence of an upset loss effect for Celtic fans. The overall conclusion remains that unexpected results are associated with increased levels of domestic violence only in a small subset of matches that occur at the end of the season where the title is still being contested.

	(B1") All matches	(B2") Importance	(B3") Extended importance	(B4") Traditional rival	(B5") Referee active
cfavwin	-0.0194	-0.0107	-0.0220	-0.0127	-0.0367
	(0.0400)	(0.0385)	(0.0388)	(0.0390)	(0.0408)
ctightwin	-0.0247	-0.00620	-0.0224	-0.00632	-0.0224
	(0.0369)	(0.0363)	(0.0354)	(0.0359)	(0.0458)
cfavdraw	-0.0330	-0.0541	-0.0659	-0.0704	0.00989
	(0.0470)	(0.0470)	(0.0483)	(0.0483)	(0.0635)
ctightdraw	-0.0498	-0.0381	-0.0442	-0.0731	-0.109
	(0.0449)	(0.0457)	(0.0480)	(0.0464)	(0.0665)
cfavlose	0.128**	0.102*	0.0988**	0.148**	0.204**
	(0.0606)	(0.0537)	(0.0454)	(0.0631)	(0.0825)
ctightlose	-0.124**	-0.110**	-0.101*	-0.112**	-0.153*
	(0.0513)	(0.0531)	(0.0585)	(0.0568)	(0.0817)
rfavwin	-0.00361	-0.00595	-0.00672	-0.00357	0.00803
	(0.0314)	(0.0320)	(0.0336)	(0.0325)	(0.0348)
rtightwin	-0.0375	-0.0465	-0.0532*	-0.0448	-0.0356
	(0.0302)	(0.0289)	(0.0307)	(0.0301)	(0.0330)
rfavdraw	-0.00238	-0.00743	-0.0000512	0.000828	-0.0739
	(0.0610)	(0.0606)	(0.0699)	(0.0598)	(0.0862)
rtightdraw	0.00412	0.00648	0.0130	-0.00223	0.0189
	(0.0386)	(0.0392)	(0.0414)	(0.0442)	(0.0502)
rfavlose	0.00598	0.00230	0.0304	0.00477	-0.0612
	(0.0584)	(0.0581)	(0.0556)	(0.0669)	(0.0627)
rtightlose	-0.0252	-0.0333	-0.0361	-0.0515	-0.149**
	(0.0420)	(0.0424)	(0.0452)	(0.0525)	(0.0720)
cfavwin_sal		0.0700	0.0148	-0.0265	-0.00631
		(0.109)	(0.0509)	(0.0537)	(0.0435)
ctightwin_sal		-0.0282	0.00700	-0.0401	-0.0268
		(0.0605)	(0.0455)	(0.0378)	(0.0381)
cfavdraw_sal		0.393***	0.208	0.150	-0.0788
		(0.0864)	(0.156)	(0.0996)	(0.0563)
ctightdraw_sal		0.0205	-0.0584	0.0335	-0.0172
		(0.0333)	(0.0491)	(0.0539)	(0.0451)
cfavlose_sal		0.316**	0.187**	0.0965	0.0447
		(0.128)	(0.0922)	(0.107)	(0.0483)
ctightlose_sal		-0.0421	-0.172***	-0.122*	-0.119**
		(0.0340)	(0.0614)	(0.0734)	(0.0579)
rfavwin_sal		-0.00326	-0.0118	-0.0509	-0.0185
		(0.130)	(0.0501)	(0.0405)	(0.0361)
rtightwin_sal		0.0277	0.00301	-0.0402	-0.0366
		(0.0685)	(0.0419)	(0.0403)	(0.0336)
rfavdraw_sal		omitted	-0.0592	omitted	0.0279
		(.)	(0.0443)	(.)	(0.0669)
rtightdraw_sal		-0.00869	-0.0349	-0.00151	0.000660
		(0.0871)	(0.0610)	(0.0475)	(0.0430)
rfavlose_sal		omitted	-0.216***	0.000435	0.133***
		(.)	(0.0317)	(0.0955)	(0.0402)
rtightlose_sal		0.193***	0.0567	0.00960	0.0264
		(0.0591)	(0.0720)	(0.0402)	(0.0453)
oldfirm_draw	0.387***	0.387***	0.388***	0.386***	0.385***
	(0.112)	(0.112)	(0.112)	(0.112)	(0.112)
oldfirm_close	0.410***	0.409***	0.410***	0.409***	0.410***
	(0.0536)	(0.0536)	(0.0537)	(0.0536)	(0.0536)
oldfirm_rlose	0.286***	0.285***	0.286***	0.286***	0.284***
	(0.0464)	(0.0464)	(0.0464)	(0.0463)	(0.0466)
cvstr	0.00169	-0.00251	-0.00814		-0.00132
	(0.0220)	(0.0214)	(0.0216)		(0.0226)
rvstr	-0.00186	-0.00460	-0.00719		-0.0105
	(0.0208)	(0.0204)	(0.0209)		(0.0204)
chome	0.00758	0.00142	0.00699	0.00568	0.0107
	(0.0346)	(0.0347)	(0.0340)	(0.0339)	(0.0346)
rhome	0.00494	0.0100	0.0119	0.00805	0.00897
	(0.0296)	(0.0295)	(0.0302)	(0.0299)	(0.0296)
ctv	0.0652**	0.0528	0.0648**	0.0552*	0.0660*
	(0.0330)	(0.0327)	(0.0312)	(0.0319)	(0.0339)
rtv	0.0512*	0.0556*	0.0635**	0.0563*	0.0469
	(0.0293)	(0.0288)	(0.0291)	(0.0296)	(0.0294)
cimp	0.0668*			0.0629	0.0630
	(0.0406)			(0.0399)	(0.0401)
rimp	0.0759			0.0638	0.0705
	(0.0489)			(0.0471)	(0.0487)
oldfirm_imp	0.106	0.106	0.105	0.106	0.107
	(0.0689)	(0.0689)	(0.0688)	(0.0688)	(0.0691)
intercept	4.229***	4.230***	4.230***	4.229***	4.228***
	(0.0143)	(0.0143)	(0.0143)	(0.0143)	(0.0144)
N	3200	3200	3200	3200	3200

Robust standard errors in parentheses

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

Table A.2: The effects of match outcomes relative to expectations when the winning probability threshold is increased to 0.8.

A.2 Negative Binomial Regressions

	(A1nb)	(A2nb)	(A3nb)	(A4nb)	(A5nb)	(A6nb)
conly	-0.00488	-0.00204	-0.0702*	-0.0526	-0.0625*	
	(0.0124)	(0.0133)	(0.0385)	(0.0352)	(0.0362)	
ronly	-0.00457	-0.00378	-0.0460	-0.0393	-0.0351	
	(0.0132)	(0.0146)	(0.0299)	(0.0286)	(0.0296)	
candr	0.142***					
	(0.0211)					
candr¬		0.0596***	-0.0527	-0.0208	-0.0230	
		(0.0204)	(0.0452)	(0.0448)	(0.0484)	
oldfirm		0.366***	0.369***	0.354***	0.401***	
		(0.0344)	(0.0351)	(0.0392)	(0.0701)	
cvstr		-0.00360	-0.00208	-0.00694	-0.00948	-0.00771
		(0.0225)	(0.0217)	(0.0210)	(0.0214)	(0.0216)
rvstr		0.000644	-0.00129	-0.00402	-0.00320	-0.00474
		(0.0224)	(0.0216)	(0.0200)	(0.0203)	(0.0206)
chome			0.0437	0.0244	0.0266	0.0205
			(0.0340)	(0.0321)	(0.0323)	(0.0324)
rhome			0.0253	0.0160	0.0155	0.0176
			(0.0297)	(0.0285)	(0.0285)	(0.0282)
ctv			0.0847**	0.0561*	0.0557*	0.0572*
			(0.0343)	(0.0329)	(0.0333)	(0.0330)
rtv			0.0599**	0.0384	0.0387	0.0463*
			(0.0288)	(0.0279)	(0.0281)	(0.0274)
cimp				0.0895**	0.0884**	0.0841*
				(0.0421)	(0.0427)	(0.0452)
rimp				0.0981*	0.0978*	0.0929*
				(0.0508)	(0.0510)	(0.0530)
oldfirm_imp				0.0900	0.117	0.107
				(0.0698)	(0.0731)	(0.0731)
cref					0.0153	
					(0.0191)	
rref					-0.0100	
					(0.0207)	
oldfirm_ref					-0.0736	
					(0.0824)	
oldfirm_draw						0.394***
						(0.112)
oldfirm_close						0.425***
						(0.0531)
oldfirm_rlose						0.291***
						(0.0480)
cwin						-0.0241
						(0.0357)
cdraw						-0.0415
						(0.0379)
close						-0.0301
						(0.0504)
rwin						-0.0257
						(0.0271)
rdraw						0.00246
						(0.0350)
rlose						-0.0270
						(0.0383)
intercept	4.222***	4.228***	4.234***	4.232***	4.233***	4.229***
	(0.0140)	(0.0138)	(0.0139)	(0.0139)	(0.0139)	(0.0139)
N	3200	3200	3200	3200	3200	3200

Robust standard errors in parentheses

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

Table A.3: Negative binomial regression estimates of specifications A1-A6.

	(B1nb) All matches	(B2nb) Importance	(B3nb) Extended importance	(B4nb) Traditional rival	(B5nb) Referee active
cfavwin	-0.0292	-0.0208	-0.0442	-0.0173	-0.0416
	(0.0370)	(0.0363)	(0.0365)	(0.0369)	(0.0389)
ctightwin	-0.0201	-0.00659	-0.0410	-0.0249	-0.0459
	(0.0405)	(0.0406)	(0.0396)	(0.0434)	(0.0706)
cfavdraw	-0.0517	-0.0613	-0.0796*	-0.0810*	-0.0691
	(0.0441)	(0.0447)	(0.0453)	(0.0453)	(0.0592)
ctightdraw	-0.0325	-0.0241	-0.0400	-0.0610	-0.0623
	(0.0440)	(0.0462)	(0.0537)	(0.0511)	(0.0924)
cfavlose	-0.0134	-0.0429	-0.0655	-0.0270	0.00391
	(0.0607)	(0.0613)	(0.0795)	(0.0699)	(0.0982)
ctightlose	-0.0598	-0.0515	-0.0753	0.00348	0.000369
	(0.0629)	(0.0623)	(0.0616)	(0.0547)	(0.0715)
rfavwin	-0.0308	-0.0364	-0.0369	-0.0351	-0.0140
	(0.0310)	(0.0307)	(0.0324)	(0.0311)	(0.0358)
rtightwin	-0.0206	-0.0328	-0.0499	-0.0181	-0.0213
	(0.0302)	(0.0295)	(0.0333)	(0.0310)	(0.0342)
rfavdraw	-0.00240	-0.0140	-0.0156	0.00371	-0.00916
	(0.0438)	(0.0446)	(0.0503)	(0.0469)	(0.0586)
rtightdraw	0.00643	0.0189	0.0387	-0.0169	0.0173
	(0.0432)	(0.0440)	(0.0448)	(0.0502)	(0.0641)
rfavlose	-0.0198	-0.0275	-0.0175	-0.0382	-0.0965**
	(0.0471)	(0.0468)	(0.0523)	(0.0517)	(0.0461)
rtightlose	-0.0330	-0.0444	-0.0476	-0.0643	-0.226
	(0.0502)	(0.0519)	(0.0530)	(0.0828)	(0.156)
cfavwin_sal		0.0172	-0.0140	-0.0769*	-0.0255
		(0.0825)	(0.0480)	(0.0408)	(0.0397)
ctightwin_sal		-0.0190	0.00309	-0.00779	-0.0250
		(0.0982)	(0.0638)	(0.0457)	(0.0427)
cfavdraw_sal		0.340**	0.0482	0.132*	-0.0455
		(0.150)	(0.147)	(0.0703)	(0.0502)
ctightdraw_sal		0.0228	-0.0644	-0.00480	-0.0343
		(0.0342)	(0.0444)	(0.0475)	(0.0436)
cfavlose_sal		0.213	0.0413	0.0368	-0.0456
		(0.132)	(0.0878)	(0.0946)	(0.0467)
ctightlose_sal		omitted	omitted	-0.124	-0.0984
		(.)	(.)	(0.0860)	(0.0755)
rfavwin_sal		0.0319	-0.0127	-0.0335	-0.0370
		(0.0762)	(0.0475)	(0.0441)	(0.0323)
rtightwin_sal		0.0762	0.0387	-0.0661	-0.00510
		(0.136)	(0.0407)	(0.0451)	(0.0377)
rfavdraw_sal		0.243***	0.0322	-0.0350	0.00940
		(0.0293)	(0.0589)	(0.0599)	(0.0497)
rtightdraw_sal		-0.0826**	-0.105	0.00925	0.00992
		(0.0391)	(0.0702)	(0.0597)	(0.0513)
rfavlose_sal		omitted	-0.132*	0.0510	0.0521
		(.)	(0.0678)	(0.0864)	(0.0635)
rtightlose_sal		0.151**	0.153***	-0.0265	0.00926
		(0.0747)	(0.0521)	(0.0383)	(0.0435)
oldfirm_draw	0.394***	0.394***	0.394***	0.393***	0.394***
	(0.112)	(0.112)	(0.112)	(0.112)	(0.112)
oldfirm_close	0.425***	0.425***	0.425***	0.424***	0.425***
	(0.0530)	(0.0531)	(0.0530)	(0.0530)	(0.0531)
oldfirm_rlose	0.291***	0.290***	0.291***	0.290***	0.290***
	(0.0480)	(0.0481)	(0.0480)	(0.0479)	(0.0481)
cvstr	-0.00825	-0.0107	-0.00931		0.000774
	(0.0221)	(0.0217)	(0.0217)		(0.0235)
rvstr	-0.00451	-0.00601	-0.00868		-0.0132
	(0.0214)	(0.0201)	(0.0218)		(0.0211)
chome	0.0249	0.0211	0.0364	0.0219	0.0279
	(0.0336)	(0.0340)	(0.0340)	(0.0340)	(0.0344)
rhome	0.0214	0.0284	0.0300	0.0221	0.0178
	(0.0321)	(0.0315)	(0.0331)	(0.0320)	(0.0323)
ctv	0.0606*	0.0549*	0.0757**	0.0564*	0.0644*
	(0.0336)	(0.0333)	(0.0326)	(0.0335)	(0.0351)
rtv	0.0459*	0.0507*	0.0620**	0.0518*	0.0400
	(0.0271)	(0.0269)	(0.0277)	(0.0276)	(0.0273)
cimp	0.0799*			0.0774*	0.0780*
	(0.0451)			(0.0440)	(0.0470)
rimp	0.0941*			0.0816	0.0939*
	(0.0530)			(0.0519)	(0.0536)
oldfirm_imp	0.107	0.107	0.106	0.107	0.107
	(0.0731)	(0.0733)	(0.0731)	(0.0731)	(0.0733)
intercept	4.230***	4.231***	4.230***	4.230***	4.230***
	(0.0140)	(0.0140)	(0.0140)	(0.0140)	(0.0140)
N	3200	3200	3200	3200	3200

Robust standard errors in parentheses

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

Table A.4: Negative binomial regression estimates of specifications B1-B5.

A.3 OLS Regressions

	(A1ols)	(A2ols)	(A3ols)	(A4ols)	(A5ols)	(A6ols)
conly	0.00348	0.00666	-0.0620*	-0.0479	-0.0587*	
	(0.0127)	(0.0133)	(0.0359)	(0.0334)	(0.0347)	
ronly	0.00147	0.00130	-0.0385	-0.0331	-0.0295	
	(0.0134)	(0.0149)	(0.0292)	(0.0284)	(0.0294)	
candr	0.139***					
	(0.0201)					
candr¬		0.0639***	-0.0450	-0.0177	-0.0219	
		(0.0202)	(0.0442)	(0.0442)	(0.0478)	
oldfirm		0.372***	0.375***	0.360***	0.407***	
		(0.0325)	(0.0331)	(0.0365)	(0.0643)	
cvstr		-0.00558	-0.00319	-0.00755	-0.0106	-0.00779
		(0.0227)	(0.0221)	(0.0218)	(0.0223)	(0.0223)
rvstr		0.00592	0.00438	0.00208	0.00259	0.00287
		(0.0215)	(0.0206)	(0.0194)	(0.0195)	(0.0199)
chome			0.0441	0.0276	0.0298	0.0246
			(0.0320)	(0.0306)	(0.0309)	(0.0309)
rhome			0.0216	0.0132	0.0125	0.0158
			(0.0290)	(0.0285)	(0.0285)	(0.0282)
ctv			0.0829**	0.0589*	0.0581*	0.0583*
			(0.0324)	(0.0316)	(0.0322)	(0.0316)
rtv			0.0578**	0.0391	0.0393	0.0453*
			(0.0283)	(0.0277)	(0.0280)	(0.0271)
cimp				0.0838**	0.0822*	0.0785*
				(0.0416)	(0.0422)	(0.0442)
rimp				0.0927*	0.0929*	0.0872
				(0.0541)	(0.0543)	(0.0557)
oldfirm_imp				0.0905	0.117	0.111
				(0.0708)	(0.0739)	(0.0708)
cref					0.0173	
					(0.0192)	
rref					-0.00795	
					(0.0205)	
oldfirm_ref					-0.0727	
					(0.0760)	
oldfirm_draw						0.396***
						(0.101)
oldfirm_close						0.431***
						(0.0508)
oldfirm_rlose						0.301***
						(0.0442)
cwin						-0.0218
						(0.0339)
cdraw						-0.0351
						(0.0362)
close						-0.0370
						(0.0506)
rwin						-0.0219
						(0.0270)
rdraw						0.00521
						(0.0347)
rlose						-0.0261
						(0.0394)
intercept	4.204***	4.208***	4.215***	4.214***	4.214***	4.211***
	(0.0138)	(0.0137)	(0.0138)	(0.0138)	(0.0139)	(0.0138)
N	3200	3200	3200	3200	3200	3200

Robust standard errors in parentheses

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

Table A.5: OLS regression estimates of specifications A1-A6; dependent variable is the log of the number of domestic violence incidents.

	(B1ols) All matches	(B2ols) Importance	(B3ols) Extended importance	(B4ols) Traditional rival	(B5ols) Referee active
cfavwin	-0.0275	-0.0212	-0.0440	-0.0179	-0.0413
	(0.0352)	(0.0348)	(0.0353)	(0.0360)	(0.0373)
ctightwin	-0.0138	-0.00286	-0.0345	-0.0187	-0.0448
	(0.0394)	(0.0398)	(0.0391)	(0.0431)	(0.0750)
cfavdraw	-0.0463	-0.0556	-0.0695	-0.0758*	-0.0653
	(0.0424)	(0.0429)	(0.0439)	(0.0439)	(0.0567)
ctightdraw	-0.0206	-0.0160	-0.0309	-0.0534	-0.0591
	(0.0440)	(0.0467)	(0.0550)	(0.0528)	(0.0921)
cfavlose	-0.0249	-0.0533	-0.0776	-0.0515	-0.0241
	(0.0615)	(0.0642)	(0.0856)	(0.0722)	(0.102)
ctightlose	-0.0578	-0.0523	-0.0736	0.00805	0.00253
	(0.0659)	(0.0657)	(0.0654)	(0.0548)	(0.0727)
rfavwin	-0.0260	-0.0305	-0.0299	-0.0318	-0.0109
	(0.0310)	(0.0309)	(0.0321)	(0.0313)	(0.0365)
rtightwin	-0.0158	-0.0276	-0.0451	-0.0164	-0.0110
	(0.0296)	(0.0293)	(0.0329)	(0.0307)	(0.0329)
rfavdraw	0.0103	-0.00226	-0.00281	0.0168	0.00680
	(0.0429)	(0.0438)	(0.0495)	(0.0455)	(0.0575)
rtightdraw	-0.00295	0.00767	0.0310	-0.0229	0.00631
	(0.0423)	(0.0438)	(0.0436)	(0.0500)	(0.0653)
rfavlose	-0.0150	-0.0221	-0.00922	-0.0364	-0.0964**
	(0.0480)	(0.0479)	(0.0541)	(0.0525)	(0.0469)
rtightlose	-0.0390	-0.0512	-0.0525	-0.0859	-0.251*
	(0.0532)	(0.0553)	(0.0565)	(0.0899)	(0.152)
cfavwin_sal		0.0166	-0.00821	-0.0800**	-0.0249
		(0.0776)	(0.0466)	(0.0404)	(0.0384)
ctightwin_sal		-0.0234	0.00450	-0.0103	-0.0189
		(0.0928)	(0.0650)	(0.0466)	(0.0415)
cfavdraw_sal		0.330**	0.00364	0.138*	-0.0419
		(0.150)	(0.145)	(0.0719)	(0.0496)
ctightdraw_sal		0.0407	-0.0475	0.00761	-0.0197
		(0.0331)	(0.0465)	(0.0478)	(0.0424)
cfavlose_sal		0.204	0.0274	0.0482	-0.0392
		(0.133)	(0.0877)	(0.0913)	(0.0446)
ctightlose_sal		0	omitted	-0.129	-0.0981
		(.)	(.)	(0.0921)	(0.0801)
rfavwin_sal		0.0262	-0.0131	-0.0268	-0.0314
		(0.0824)	(0.0486)	(0.0420)	(0.0326)
rtightwin_sal		0.0982	0.0505	-0.0480	-0.00557
		(0.138)	(0.0407)	(0.0438)	(0.0384)
rfavdraw_sal		0.270***	0.0503	-0.0266	0.0183
		(0.0290)	(0.0621)	(0.0600)	(0.0487)
rtightdraw_sal		-0.0682*	-0.100	0.00368	0.00151
		(0.0395)	(0.0731)	(0.0522)	(0.0487)
rfavlose_sal		0	-0.120*	0.0737	0.0568
		(.)	(0.0678)	(0.0874)	(0.0655)
rtightlose_sal		0.157**	0.157***	-0.0174	0.00590
		(0.0708)	(0.0503)	(0.0410)	(0.0456)
oldfirm_draw	0.396***	0.396***	0.396***	0.395***	0.395***
	(0.101)	(0.101)	(0.101)	(0.101)	(0.102)
oldfirm_close	0.431***	0.431***	0.431***	0.430***	0.431***
	(0.0509)	(0.0510)	(0.0510)	(0.0510)	(0.0511)
oldfirm_rlose	0.301***	0.301***	0.301***	0.300***	0.300***
	(0.0443)	(0.0444)	(0.0444)	(0.0443)	(0.0445)
cvstr	-0.0102	-0.0113	-0.00907		-0.00182
	(0.0226)	(0.0224)	(0.0224)		(0.0240)
rvstr	0.00438	0.00281	-0.000433		-0.00470
	(0.0208)	(0.0196)	(0.0213)		(0.0205)
chome	0.0299	0.0281	0.0418	0.0290	0.0337
	(0.0321)	(0.0326)	(0.0330)	(0.0332)	(0.0333)
rhome	0.0167	0.0238	0.0251	0.0188	0.0143
	(0.0320)	(0.0320)	(0.0328)	(0.0320)	(0.0326)
ctv	0.0607*	0.0568*	0.0744**	0.0591*	0.0656*
	(0.0323)	(0.0323)	(0.0321)	(0.0330)	(0.0341)
rtv	0.0455*	0.0501*	0.0596**	0.0534**	0.0402
	(0.0268)	(0.0267)	(0.0275)	(0.0272)	(0.0272)
cimp	0.0758*			0.0763*	0.0716
	(0.0443)			(0.0435)	(0.0461)
rimp	0.0896			0.0775	0.0899
	(0.0556)			(0.0549)	(0.0569)
oldfirm_imp	0.111	0.111	0.110	0.111	0.112
	(0.0709)	(0.0711)	(0.0710)	(0.0710)	(0.0711)
intercept	4.211***	4.212***	4.211***	4.211***	4.211***
	(0.0139)	(0.0139)	(0.0139)	(0.0139)	(0.0139)
N	3200	3200	3200	3200	3200

Robust standard errors in parentheses

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

Table A.6: OLS regression estimates of specifications B1-B5; dependent variable is the log of the number of domestic violence incidents.

B Mixed effects model

As noted in Section 3, one potential drawback of our analysis stems from fans of the two teams under consideration being located in the same region. If, for example, Celtic fans take pleasure from Rangers suffering an unexpected defeat and this leads to a reduction in acts of domestic violence committed by Celtic fans then the effect of the unexpected loss for Rangers will be under-estimated. We argued that it is reasonable to assume that domestic violence would not substantially reduce through such an indirect effect and therefore have assumed that the effect of a disappointing result for a team can be identified. In order to present a further argument to add some justification to this assumption, we can explore a mixed effects model that allows estimates of some carefully chosen parameters to vary across subdivisions. Whilst Glasgow is not a segregated city in terms of the location of football supporters, in some regions support is predominantly in favour of one team, which will allow us to obtain a clearer picture of whether our assumption is reasonable.

The mixed effects Poisson model involves grouping the explanatory variables into those with constant coefficients (Z_t) and those with coefficients which vary across subdivisions (W_t). If y_{it} is the number of domestic violence incidents in subdivision i on day t then Poisson panel data models assume:

$$\Pr\left(y_{it} = y|\alpha_i\right) = \frac{\exp\left(-\lambda_{it}\right)\lambda_{it}^{y}}{y!}$$

for $y = 0, 1, ...$ The mean is given by:

$$\lambda_{it} = \exp\left(Z_t\beta + W_t\alpha_i\right).$$

The vector of varying coefficients, α_i has a multivariate Normal distribution with diagonal error covariance matrix. Note that mixed effects models can be difficult to estimate precisely when the dimensionality of α_i becomes too large. Accordingly, it is common to allow for only a few explanatory variables to have varying coefficients, a practice that we follow here. In particular, we re-estimate model (B1) but allow the coefficients for `oldfirm_close`, `oldfirm_rlose`, `cfavlose` and `rfavlose` to vary across subdivisions. These are the coefficients that we would expect to vary across subdivisions if there are distinct Rangers (Celtic) neighbourhoods.

In practice, we find that coefficients estimates do not vary much across subdivisions. The average coefficients estimates (i.e. β and the mean of α_i) are basically the same as those of model (B1), and so are not presented here. Table A.8 gives estimates (and standard errors) of the deviation of each coefficient

from the average in each of the 30 police subdivisions using the mixed effects model (estimated using Stata's `xtmepoisson` command). For two of the variables with subdivision-varying coefficients (`oldfirm_close` and `rfavlose`) these deviations are essentially zero. For the remaining two variables (`oldfirm_rlose`, `cfavlose`) there is more evidence that their impact varies across subdivision. However, even for these variables, almost all of the estimated deviations are less than one standard deviation from zero and none are more than two standard deviations from zero.

The drawback referred to at the beginning of this section would manifest itself if the correlation between the coefficients on `cfavlose` and `rfavlose` or on `oldfirm_close` and `rfavlose`, or on `oldfirm_rlose` and `cfavlose` were strongly negative. These correlations would mean that in subdivisions where domestic violence increases when Celtic (Rangers) fans receive bad news it tends to reduce when Rangers (Celtic) fans receive bad news. The correlations between the point estimates (ignoring the fact that standard errors tend to be quite large) are given in Table A.7. Given the limited variability across subdivisions of some estimates, we focus on the correlation between `oldfirm_rlose` and `cfavlose`: if this is strongly negative then in subdivisions where `oldfirm_rlose` is higher than average (domestic violence increases more than average when Rangers receive bad news), `cfavlose` will be less than average, with the implication that Rangers fans might be taking pleasure, and therefore committing fewer acts of domestic violence, when Celtic suffer an upset loss. However, whilst negative, this correlation is quite small and therefore does not suggest that countervailing Rangers and Celtic effects mask each other.

	oldfirm_close	oldfirm_rlose	cfavlose	rfavlose
oldfirm_close	1.0000			
oldfirm_rlose	0.3889	1.0000		
cfavlose	-0.3400	-0.2059	1.0000	
rfavlose	-0.2183	-0.2296	0.3952	1.0000

Table A.7: Correlations across sub-divisions between random effects.

The fact that our results using a mixed effects model on subdivision level data do not indicate substantial variations in coefficients could be due to the scale of police subdivisions. That is, the average police subdivision contains about 75,000 inhabitants and this degree of spatial resolution may be too coarse to pick up effects associated with neighbourhoods of a particular sectarian hue. But, at least the findings of this section are suggestive that our results of Section 5 are not missing important effects due to regional variations within the Strathclyde region.

	oldfirm_close		oldfirm_rlose		cfavlose		rfavlose	
subdivision	est	se	est	se	est	se	est	se
Average	.4098667	.0265469	.2791021	.0318814	-.0183021	.0429036	-.0241429	.0379596
1	-3.51e-10	.0000178	.0145717	.0886246	-.0095377	.0894032	4.19e-11	3.16e-06
2	4.80e-10	.0000178	-.0409088	.0907704	-.0320484	.0906564	3.11e-11	3.16e-06
3	-2.25e-09	.0000178	.0137195	.0829717	-.0188492	.0857157	-8.82e-11	3.16e-06
4	-5.77e-10	.0000178	-.0761421	.0756436	-.0839154	.0802242	1.04e-12	3.16e-06
5	1.16e-09	.0000178	.0026258	.075548	-.0258421	.0803736	-5.05e-11	3.16e-06
6	-2.27e-09	.0000178	.0157724	.0774168	-.0346071	.0819714	7.07e-11	3.16e-06
7	2.82e-10	.0000178	.0409148	.0703918	.0416579	.0760176	-3.17e-11	3.16e-06
8	2.57e-09	.0000178	-.0749129	.077453	.0480438	.0802122	8.06e-11	3.16e-06
9	1.11e-09	.0000178	.0966942	.0815901	-.0189568	.0854004	-1.77e-11	3.16e-06
10	-6.59e-11	.0000178	.0363059	.0763423	-.0023609	.0810696	-5.81e-11	3.16e-06
11	-1.93e-09	.0000178	.0295256	.0794474	-.0098541	.08332	7.16e-11	3.16e-06
12	1.71e-09	.0000178	.0022421	.0855686	-.0097254	.0873371	-2.17e-11	3.16e-06
13	-9.01e-10	.0000178	-.0970828	.0815881	.05686	.0831927	3.59e-11	3.16e-06
14	-5.82e-13	.0000178	-.0736117	.0794008	.0474526	.0817793	-4.90e-11	3.16e-06
15	-1.43e-09	.0000178	-.0805147	.0751176	-.0256493	.079118	-5.56e-11	3.16e-06
16	-2.48e-09	.0000178	.0571618	.0777625	.0284044	.0820093	-2.77e-11	3.16e-06
17	1.25e-09	.0000178	.023115	.0776008	.0039263	.081798	7.74e-11	3.16e-06
18	-3.34e-09	.0000178	-.0254234	.0696729	-.0142166	.0752988	-8.06e-11	3.16e-06
19	5.59e-10	.0000178	-.0348854	.0840499	-.053969	.086357	-7.09e-12	3.16e-06
20	5.03e-09	.0000178	.1320052	.0703782	-.041735	.0781926	-8.76e-11	3.16e-06
21	-1.46e-09	.0000178	.0287002	.0801809	-.0467895	.0841426	3.75e-11	3.16e-06
22	-1.73e-09	.0000178	-.0463458	.0822698	.0236056	.0844319	-6.21e-12	3.16e-06
23	2.93e-10	.0000178	.0501145	.0737266	.0964271	.0781128	6.91e-11	3.16e-06
24	3.13e-09	.0000178	.0334464	.0827286	-.0120527	.0856436	-1.92e-11	3.16e-06
25	2.92e-09	.0000178	.0095051	.074862	-.0304066	.0799846	3.68e-12	3.16e-06
26	-1.77e-09	.0000178	.0174798	.0854602	.0438677	.0870294	3.86e-11	3.16e-06
27	1.61e-09	.0000178	.0043046	.081856	-.009639	.0848042	1.68e-11	3.16e-06
28	4.31e-09	.0000178	.0711645	.0675177	-.0654568	.0755525	-7.93e-11	3.16e-06
29	-2.76e-09	.0000178	-.0932648	.0744157	.0716652	.0772259	4.76e-11	3.16e-06
30	-3.12e-09	.0000178	-.0073519	.0730897	.1064985	.076761	5.66e-11	3.16e-06

Table A.8: Mixed effect model estimates of the deviation of coefficients from the average across subdivisions.